ACORN USER

BBC micro, Electron and Atom magazine

December 1983 £1

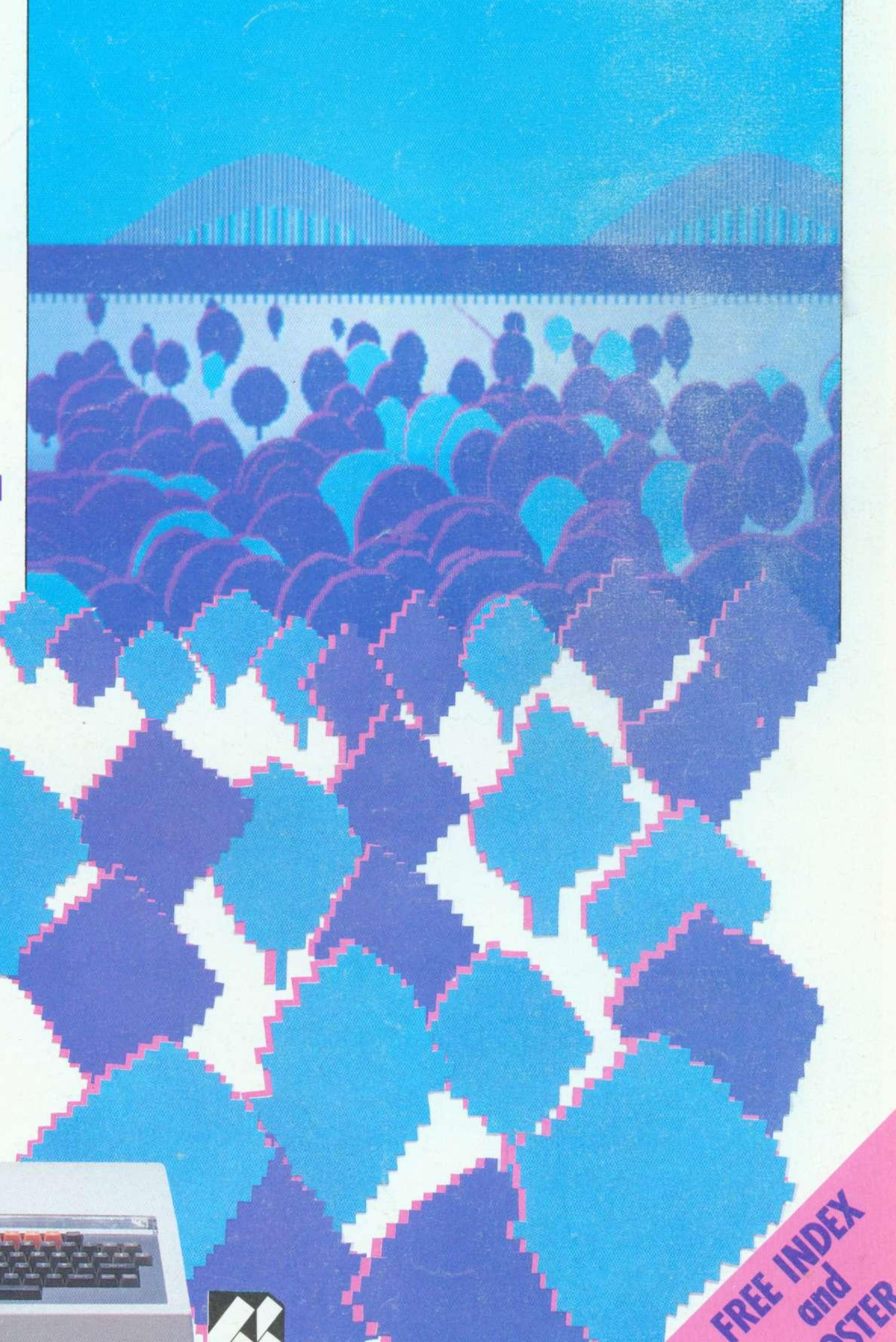
ELECTRON: interfacing

BBC GRAPHICS: fruit machine

PRINTERS: all-mode dump

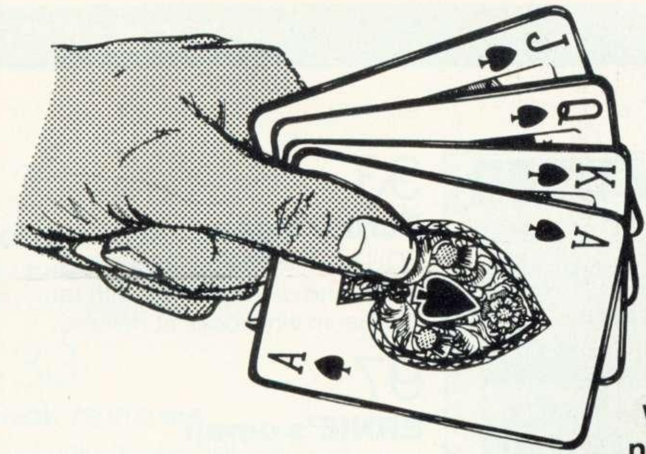
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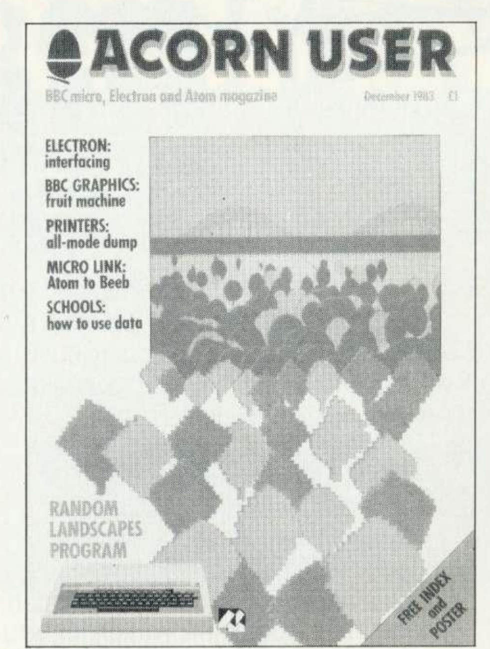
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How to submit articles:
You are welcome to send articles to the Editor of *Acorn User* for publication. *Acorn User* cannot undertake to return them unless a stamped addressed envelope is enclosed. Articles should be typed or computer written with double line spacing. Black and white photographs or transparencies are also appreciated. If submitting programs a cassette or disc is vital. Payment is £50 per page or pro rata. Please indicate if you have submitted your article elsewhere. Send articles, reviews and information to: The Editor, *Acorn User*, 53 Bedford Square, London WC1B 3DZ. Tel: 01-631 1636.

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Coming soon in *Acorn User*:

Games:
Our special issue presents a major listing of The Train Game, other authors explain how to write games, and produce machine code graphics. Plus software reviews

Electron:
Paul Beverley puts his 6522 interface outlined in this issue to work by downloading programs to the Beeb's printer port

Life:
A graphics program produces crystal shapes which appear to grow

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Our own regular run-down of the big sellers, and analysis of what's going on

Atom venture:
A yes/no adventure which produces a special message

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We persuade the experts to let you in on their secrets

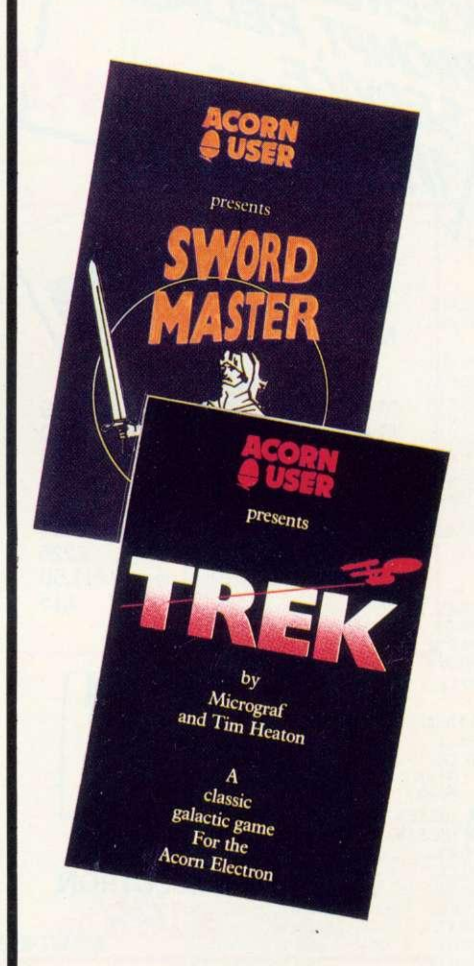
Authors please note

We've been inundated with articles for publication – many of an extremely high standard. It takes time to read them, try listings out and edit them – which is the only way to maintain standards. Also remember that magazines work at least two months in advance.

So please bear with us if you hear nothing for weeks (although all submissions are acknowledged).

Thanks for your patience and apologies for any frustration caused.

Two games for BBC micro and Electron



Acorn User launches software at £7.95

TWO games are now available from *Acorn User*. They are Sword Master (BBC B and Electron) and Trek (BBC B and Electron). Both make extensive use of the excellent graphics, speed and sound of the machines. **Turn to page 20 for details.**

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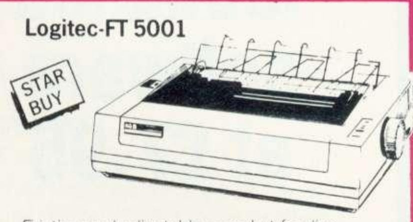


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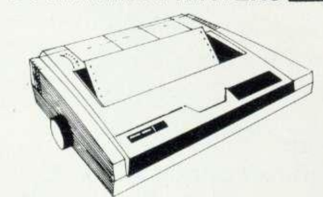


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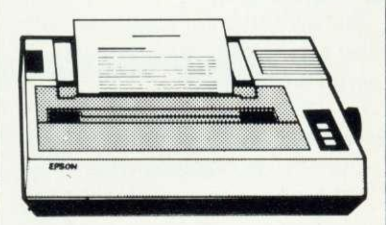
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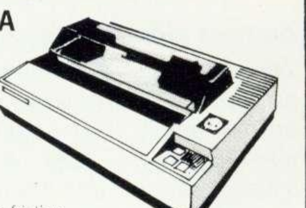
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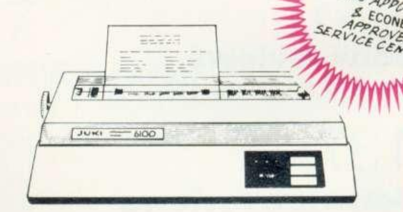
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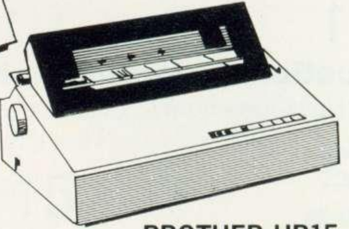
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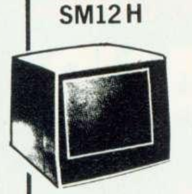
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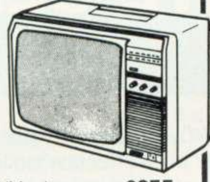


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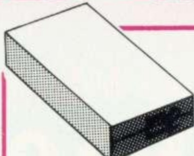
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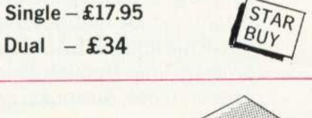
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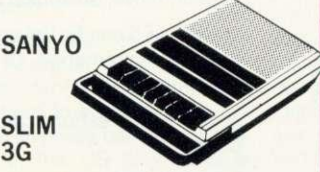
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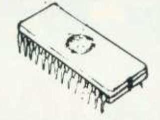
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Acorn in two sponsor deals

ACORN only expects to sell about 60,000 Electrons before Christmas—leaving 100,000 orders on the waiting list.

Production of the machine in the Far East has yet to reach its full capacity of 25,000 a month, and the British manufacturing base will not start up until January.

But Acorn does not expect to lose sales. A spokesman reckoned many buyers would wait, and that other computer makers would also be unable to meet demand.

Electrons have been dribbling into dealers and W H Smith, the only major retail outlet. Stores are turning people away and telling them to ring up and come in if there have been any deliveries.

■ CHESS and Olympic trials are to benefit from Acorn sponsorship.

The London world championship eliminator featuring Korchnoi will be financed to the tune of £60,000 over the month it takes to complete.

BBC micros will not be used, but they will be in action for timing trials in the eliminators for Britain's Olympic athletes. Diners Club is sponsoring the events, and Acorn is providing computing services.

■ THE BBC-based version of Robocom's Bitstick, which uses the 6502 second processor, will be released before Christmas.

However, no details on pricing had been finalised, said a company spokesman.

■ ON THE subject of second processors, the release date is now February next year for the Z80. Again, no final price has been announced.

Beeb in valley of the giants

THE International Computer Graphics Conference is one for the big boys. Delegates from the US come to Britain to show what they've been doing with Cray computers and hardware costing millions of pounds.

But even in the middle of all this impressive power, a BBC micro was there to fly the flag.

Nigel Balchin of the Welding Institute gave a talk on using the Beeb to generate animation, fulfilling a role formerly done on the Institute's DEC2020 minicomputer.

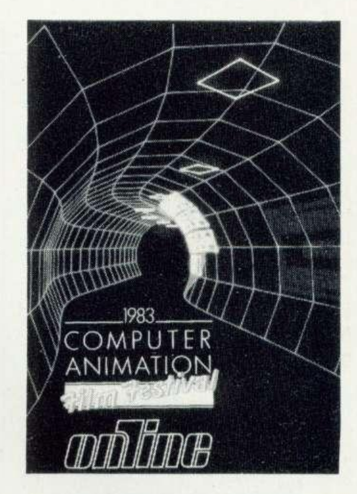
The audience seemed unsure how to react to such minimal hardware, but was soon won over. As one delegate said: 'It's fine having massive systems for complicated work, but they make it difficult to do the simple things a BBC micro is ideal for.'

The conference also featured a computer animation film festival, with awards for the best entries. It was hosted by Barry Norman, no less, and featured some amazing clips from advertising and Hollywood blockbusters such as *Star Wars* and *Superman*.

The overall winner came from the New York Institute of Technology, featuring a computer film called *The Works* which made *Tron* look feeble. It overshadowed British entries like the Channel 4 logo, the closing titles from the puppet series *Terrahawks* and advertising showreels.

But, again, as the judges made their decisions, the BBC micro popped up. This time it was behind animation done for Granada TV's *Krypton Factor*.

Two appearances was pretty amazing going for a humble micro, but it will be interesting to see what turns up next year, when the second processors are available. And the year after that? The 16032 with its 1Mbyte of memory might well make some running.



One delegate was seen reading Shaw and Ferguson's BBC assembly language book and several had copies of *Acorn User*. But the final word goes to Nigel Balchin in his references: '*Acorn User* . . . the most relevant of a vast range of magazines.'

16032 seen in action

THE 32-bit 16032 second processor for the BBC micro has been seen in action – months before its official launch.

The package was running a demonstration program at Systems 83 in Munich during October. Acorn was nowhere to be seen because the 16032 chip was being shown by its makers, the US firm National Semiconductor.

In fact, Acorn refuses to talk about the device, and stresses that it is months away from release with no prices, or marketing policy decided. 'No comment' is the only comment.

However, a spokesman for National Semiconductor said: 'We are negotiating with Acorn and two other companies to put the Unix operating system on to the BBC machine.' The two other companies are software specialists Microsoft and Logica.

Unix was developed for mainframes by the world's biggest company, AT&T (Bell Laboratories). Now computer firms are scrambling to put Unix on micros.

Like most 'standard' software, Unix comes in several versions: the BBC micro will get Xenix – Unix converted for micros by Microsoft, who wrote the operating system for the IBM Personal Computer.

In Britain, Xenix is handled by Logica and that company is already at work putting Xenix on the BBC.

Acorn has yet to decide where the 32-bit add-on processor will be aimed as this will depend to a large extent on price, and what software it comes with.

One of its main uses could be in networking, an area in which Acorn has expressed special interest. But its main advantage is that, when used with the right software, it will be incredibly fast. Chip companies call devices like the 16032 'micromainframes'.

Acorn also appears to be preparing the way for a 32-bit desktop business system. Such a machine could then be based on National Semiconductor's latest offering – the 32032.

This chip is three generations ahead of the 6502 microprocessor used in the BBC micro, and samples have just been made available to systems designers. It will go into production next year.

National Semiconductor has been impressed with the technical skills of Acorn's Hermann Hauser (who is Austrian) said the chip company's German head, Uwe Hansem. The two companies have been strengthening ties since Acorn first approached National Semiconductor in 1982 to develop the 16032 add-on.



Magic series from Central

MAGIC Micro Mission is a new series on computing by Central TV.

The aim, say its makers, is to demistify computers (haven't we heard that before?) and explore the possibilities for tomorrow.

Adrian Hedley and Jo Wheeler are the two presenters who put over a show 'packed with fun, zany jokes, colour and costumes'.

'A technological *Tiswas*' is how Central describes it, with Hedley playing the 'weird Beano-reading captain' of a spaceship broadcasting from the far end of the universe.

Wednesday at 5.15pm is the broadcast time and all the programme's graphics have been produced on a home micro. To contrast with the zany presenters, Dr John Barker from Warwick University will act as the regular 'egghead'.

Six packs from Griffin

GRIFFIN & George has launched six educational programs for children in the 4-9 age bracket.

Each takes the form of instructional booklets for parents plus tapes for the 32k BBC micro.

All six programs have been developed with Fisher-Marriott, and the packages go out under the banner Griffin Software.

The six releases are: *Wordspell* (spelling) *Getset* (numbers) *Numberfun* (addition and subtraction) *Tablesums* (multiplication) *Fairshare* (division) and *Wordgames* (more advanced spelling).

Advert complaints

PEOPLE in Aylesbury don't like Acorn it appears. Two complaints about the company's advertising have been upheld by the Advertising Standards Authority.

Both points related to claims that the BBC machine made up three out of every four micros going into schools.

Till games us do part

MARRIAGE guidance is the subject of new programs for the BBC and Electron produced by two leading psychiatrists.

Professor Hans Eysenck and Dr Glenn Wilson compiled the questionnaires used in *I Do* and *The Dating Game*, which were written for Acorn by Ivan Berg Software.

Eysenck explained that *I Do* uses simple questions to assess the personality, sexuality and attitude of people. This is then used to decide whether they would be compatible marriage partners.

The tests are fairly standard, in fact Eysenck established his reputation developing them and is now Emeritus Professor at the Institute of Psychiatry.

The computer is merely used to ask the questions and assess the results, according to a set points system. 'It's an obvious thing to do', he said, 'as it's rather boring doing it by hand.'

Similar software is already available in the US, as well as IQ and personality tests – and some of it is already used by marriage guidance counsellers.

Dr Glenn Wilson wrote the questions for *The Dating Game*. This has a similar multiple-choice question format to determine love styles, preferred relationships, dating skills, partner compatibility and general compatibility.

'It's entertaining', he said, 'but is based on sound principles. It could be used as an early warning system in marriage guidance.'

The program can be used by a group of people, in which case it will decide which individuals were best suited. 'This could be a talking point,' said Wilson.

Results of the general compatibility tests could also help decide whether people would be suited as business partners or flatmates.

Professor Eysenck's book *I Do: Your Guide to a Happy Marriage* was published in the summer and gives a detailed analysis of the tests.



Spike plug

THE PowerCleaner plug is designed to prevent damage or disruption to electronic equipment in the case of a power surge or mains spike.

It costs £8.65 (plus VAT) from B&R Electrical Products, Temple Fields, Harlow, Essex CM20 2BG.

BBC booklet

THE authors of *An Introduction to Microcomputers in Teaching*, reviewed by Paul McGee in July's issue have produced a booklet of BBC programs to go with the book.

The main criticism in the review was the book's bias towards the RML machine.

Hutchinson Education, 17 Conway Street, London W1P 5HL, stock the booklet.

ASK Acornsoft

ACORNSOFT now market the ASK range of educational programs, several of which have been reviewed in *Acorn User*.

The range is aimed at children aged 3 to 11, and each program costs £9.95. The BBC cassettes will soon be followed by Electron versions, says Acornsoft.

ASK software includes: *Number Chaser, Words, Cranky, Table Adventures, Children from Space, Facemaker, Hide and Seek, Let's Count, Number Gulper* and *Number Puzzler*.

Acornsoft already markets the Bourne range, the latest addition to which uses the voice synthesis chip.

Index software

TWO card index programs, *Collector's Catalogue* and *Membership List* have been released by Acornsoft at £9.95 each.

The names are self-explanatory, but the software will not be available on disc.

COCKNEY RHYMING BASIC RESULTS

OUR Cockney Rhyming Slang Basic competition elicited a stack of entries (and some complaints from Wales—'what's wrong with a Welsh Basic?' Several people reckoned there already was one on a TI machine).

We picked out these four, with Dan Jones coming out on top with a short listing. He gets £20-worth of Acornsoft games.

No one came up wth anything for RND, COLOUR, PROC, VDU, GOTO or CHR$, so we suggest FOREIGN LAND, EVEN DULLER, TICK-TOCK, WINNIE THE POOH, LADIES LOO and WEDDING RING.

Because of the complex gaping-cracks, each currant-bun of a CRS BASIC Pete-and-Pam is preceded by a complete Brahms-and-Listing, similar to that produced when disassembling. Each string-and-twine number is followed by the tokenised form of CRS Basic used on entry. The next column contains the expanded version, and the last column is the QE Basic equivalent (ie Queen's or BBC English).

If any silly reader will forward a pony, I will supply a complete Brahms-and-Listing of a Pete-and-Pam guaranteed to forecast eight no-score draws. This is similar to the one which recently fell off the back of an Acorn bus.

Paxtibi
Dan Jones
London

From Pat Cousins in Dublin:

HIDE AND SEEK	PEEK
PET AND STROKE	POKE
PROGRAM'S GRAVE	SAVE
DOWN THE PUB	GOSUB
US AND THEM	REM
HER AND HIM	DIM
FORGIVE AND FORGET	LET
COURT ADJOURN	RETURN
ROUND THE BEND	END

From Neil Simpson in Mossley:

BIRD'S EYE VIEW	NEW
PENNY BUN	RUN
PEPPER MINT	PRINT
PARKING FINE	LINE
PEACE AND WAR	FOR

From Rob Bamforth in Bath:

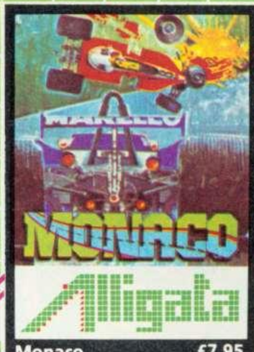
OXFORD ROAD	MODE
PINT OF BEER	CLEAR
PLASTIC TRIM	DIM
APPLE CORE	FOR
LOVER'S TIFF	IF
COLOUR TINT	INT
BILL 'N' BEN	THEN
BOW BELLS	ELSE
OVERSEXED	NEXT
BLACK 'N' BLUE	TRUE
LAST WALTZ	FALSE
DIRTY PHOTO	GOTO
POLO MINT	PRINT
BOTTLE TOP	STOP
ROUND THE BEND	END

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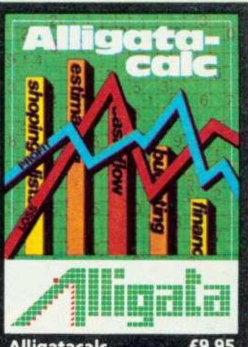
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Alligata

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CASSETTE FIFTEEN: LEAP FROG



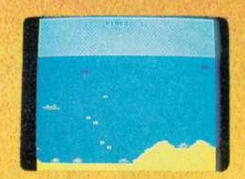
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The superb fast action m/c arcade type game. Guide your submarine Nautilus along the undersea landscape and through the caverns avoiding mines, depth charges, rockets, jelly fish, serpants etc. Features skill levels and user selected keys.
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Plane prizes

PRIZES worth £500 await the best program allowing a micro to be used as a flight simulator.

The competition is being run by the Royal Aeronautical Society, entries from both individuals and school teams must be submitted by the end of November. A copy of the rules and an entry form with information and guidelines is available from the Society.

Send your application, enclosing a stamped addressed envelope to: Flight Simulation Program, The Secretary, Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ.

Dubai debut

DUBAI is the latest corner of the world to succumb to the delights of the BBC micro. The machine made its debut at the Dubai International Trade Centre in October linked to a Torch Z80 disc pack.

Key Information Technology, who market the micro, says it is attracting a great deal of interest from schools in the United Arab Emirates. KIT is at PO Box 290, Dubai, UAE. Tel: 474489.

Diary dates

TELESOFTWARE is the subject, and Heathrow the venue for a conference in September 1984 being organised by the Institution of Electronic and Radio Engineers.

Lawson Brown from the BBC, Tony Sweet from Prestel, and Chris Dowsett, Rediffusion, have been invited to chair sessions on broadcast systems, interactive systems and wideband cable.

Details from the Conference Secretariat, IERE, 99 Gower St, London WC1E 6AZ.

A WORKSHOP and fair on micros in engineering has been organised by the IMechE for November 30. Software will be demonstrated on the BBC micro, and the Microsight digitising camera will be on show. The event will take place at the Institution's premises in Birdcage Walk and is open to the public from 3.30 to 5pm.

Econet is a hit in Australia

THE BBC micro has been very successful in the educational market in Australia, with more than 100 Econet systems installed.

Many other schools and colleges of further education have acquired Beebs, and the education departments of three states, Western Australia, South Australia and Tasmania, are producing software for use in schools.

The Australian Broadcasting Corporation is understood to be introducing BBC micros as low-cost teletext terminals, with software developed by the BBC. The Industrial Arts School of the Canberra College of Advanced Education has also expressed interest in this system.

Surprisingly, the Beeb has made little impact on the hobby market, and has yet to be reviewed by computer magazines.

Even the BBC television series *The Computer Programme* failed to create much public interest – but it was shown only during schools' broadcasts.

Three user groups have been established to date. Two of these, the Acorn Educational User Group, in Melbourne, and Beebnet in Adelaide, have been formed to cater for schools and educational users, whilst the third is orientated more towards hobbyists.

Both educational groups publish newsletters, and the importers of the computer, Barson Computers, have launched their own newsletter, *Acorn Update*.

Commercial software is still limited mainly to the Acornsoft and BBC ranges. Many dealers have only two or three items on sale, although some are trying to import titles from Britain.

Mr Men star for Mirror

MR MEN characters will feature on one of the first software releases from Mirrorsoft – a new arm of Mirror Group Newspapers.

Three packs will be released at the end of November, two of which will run on the BBC micro and Electron.

And we could see other *Daily Mirror* cartoon characters – Andy Capp, Garth, The Perishers, or even Fosdyke's tripe – stepping onto a VDU.

Jim Mackonochie, development manager at MGN, said none of the first three tapes featured these, but added: 'If a software house wants to use a character in the paper, we will consider that.'

He said Mirrorsoft was a long-term venture as 'computers will become part of the furniture of the home.' Products will be aimed at the games and home education sector.

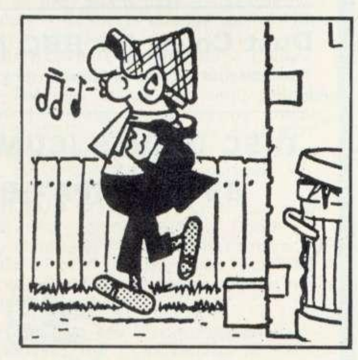
Mirrorsoft is acting as a publisher, with its own vetting team, but it is not writing any games. The second release, *Quick Thinking*, has been written by Widjeit Software and has some educational content, said Mackonochie.

Software publishing is one of 25 projects MGN is expanding into, which include cable, video and satellite TV. Also, the product division is evaluating a lightpen for use with micros.

Mirrorsoft will have its own identity and logo, although it will be red and the titles will be advertised in the *Daily Mirror* and *Sunday Mirror*.

As we went to press the price of the software had not been finalised, although Mackonochie stressed that no products would be advertised until they were 'in the warehouse'.

Mackonochie himself has a BBC micro, and said he knew the frustrations of software being advertised and promoted before it was available.



Andy Capp and The Perishers



Olivetti daisy interface

AN INTERFACE allows the BBC micro to use an Olivetti Praxis daisywheel typewriter as a printer. The £69 device, which is slightly larger than a cassette box, plugs into the RS423 port and operates at 300baud. It attaches to the side of the typewriter.

The unit does not affect normal operation of the typewriter, and is available from Timtom Micro, 9 Ilton Road, Penylan, Cardiff CF2 5DU.

Acorn backs big floppies

VOGAN Products has developed an 8in floppy disc operating system which is compatible with the standard Acorn DFS.

The 8-DFS operating system will work with most 8in floppy drives, including single- and double-sided and double-density drives in a single density mode.

The larger discs give a potential storage of nearly 1.2Mbytes, as 77 tracks per surface are used with 15 256-byte sectors per track.

Two directories can be assigned per disc surface, giving up to 62 files.

The system is Acorn-approved, and comes in an EPROM containing the DFS and utilities.

8-DFS costs £44.95 plus £1.50 postage. The manual is sold separately at £3.

Vogan also has a copying service to transfer files between 5¼ and 8in systems. Vogan Products, The White House, 21 Grove Road, Hazlemere, Bucks HP15 7QY.



Cassette aids

HELP is at hand for frustrated micro users in the shape of a cassette recorder from W H Smith, but at £39.95 it's not cheap.

The CPD8300 operates through the usual microphone and ear sockets, but record and save levels are adjustable and the speaker volume can be controlled. A year's guarantee is included with the machine.

The company has also extended the number of branches stocking the BBC and Electron micros from 28 to 31. Three more specialist computer shops have opened in Exeter, Cardiff and London's Kensington High Street.

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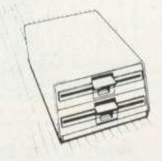
- BBC1 16K Memory (8 x 4816AP-3 100nS) £20.00
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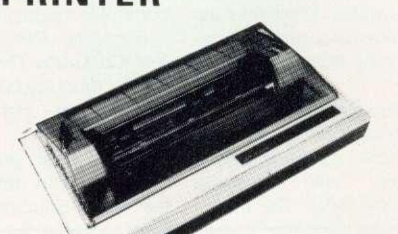
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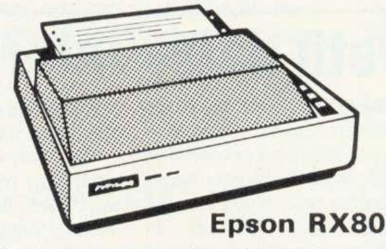
- Spare RIBBON for GP80 **£4.50**
- Spare RIBBON for GP100 **£4.95**
- Spare RIBBON for GP250 **£5.95**

SEIKOSHA GP-700

A 7 colour graphic printer at the price of a standard dot matrix printer. Its unique 4 hammer method enables text and high res graphics to be drawn in 7 basic colours or 30 shades. 7 × 8 matrix. Up to 106 char. per line at 50 CPS. Variable line spacing to 1/120". Tractor or Friction feed. Centronix interface standard.

ONLY £375 (£7 carr.)

GP-700 Colour Printer **Screen-dump** routine in **ROM FOR BBC** Micro £12



Epson RX80

100 CPS, 9 × 9 matrix, dot addressable graphics, condensed and double width printing. Normal, Italic and Elite Characters. Tractor feed, 10" max width, bi-directional, logic seeking. Centronics Interface standard.

ONLY £255 (£7 carr.)

RX80 F/T PRINTER: As above but has both Friction and Tractor feed £284

Epson FX80 Printer

160 CPS, 11 x 9 matrix, proportional spacing, superscripts, subscripts, dot addressable graphics. Normal, Italic and Elite characters. Up to 256 user definable characters. Down loadable character set. Condensed and double width printing. Full proportional spacing. Four user defined margin positions. Tractor and Friction feed. 10" maximum width Bi-directional, logic seeking Centronics interface standard.

ONLY £369 (£7 carr.)

RX & FX INTERFACES

RS232	**£38.00**
RS232 plus 2K Buffer	**£75.00**
IEEE 488	**£70.00**
Parallel 2K	**£62.00**

	Ribbons	Dust Covers
MX80FT	£4.75	£4.50
MX100	£10.00	£5.25
FX80	£4.75	£4.95
RX80	£4.75	£4.50

PRINTER INTERFACE BUFFER

When your system tries to serve you well but its efforts are frustrated by slow printers delaying from returning to more productive tasks then this is where our Printer Buffer Interface comes to your rescue. Available in 16K or 48K memory sizes. Simply connect the integral cables to your Micro and the Printer and switch on. The free standing compact unit (130x 135x40mm) is supplied complete with interface cables, a power supply and a comprehensive manual.

Price: (16K) **£120**

BROTHER 8300 DAISY WHEEL PRINTER/TYPEWRITER

Provides high quality type in six interchangeable styles. Ideal for business use. Friction feed; 11 cps; 12 inch max. width; 5 different colour ribbons; portable; hard top cover with carrying handle; connects directly to BBC Micro.

ONLY **£395** (£7 carr.)

★ SPECIAL XMAS OFFER ★

- Cumana CS50A Drive..... ~~£180~~ £165
- Cumana CS50F Drive...... ~~£310~~ £275
- Cumana CS50F Drive...... ~~£599~~ £530
- Seikosha GP100A PRINTER.................. ~~£170~~ £155
- Seikosha GP250X PRINTER................. ~~£225~~ £199
- Epson FX80 PRINTER..... ~~£369~~ £349

LISTING PAPER

$8\frac{1}{2}$" x $9\frac{1}{2}$" Fanfold paper plain or ruled (1000 sheets) **£7** (£1.50p carr.)

15" Fanfold paper (1000 sheets) **£9** (£1.50p carr.)

Teleprinter Roll (econo paper) **£4** (£1.50p carr.)

PRINTER LEAD 36"

Ready made printer lead to interface BBC Micro to EPSON, SEIKOSHA, NEC, etc., Printers.

ONLY £10

Special Extra long (60") Cable **£14**

BBC Micro WORD-PROCESSING PACKAGE

A complete word processing package consisting of: BBC Model B, Zenith 12" Green Monitor, Twin 200K highly reliable (1 year warranty) Twin Cased Disc Drives with own power supply, the popular WORDWISE word processor, Watford's own highly sophisticated 62 File DFS interface fitted, the world renowned Brother 8300 Daisy Wheel Printer/Typewriter, Gemini's Beebplot & Beebcalc Spreadsheet Analysis Software tapes, 10 blank diskettes, 500 sheets of Fan-Fold paper, Manuals and all the leads.
All you require is a mains power point to have it up and running (we even supply the 4 way mains socket).

ONLY **£1,350** (carr. £15)

(P.S. We will alter the package to suit your particular requirement. Call in for a demonstration.)

MONITORS



MICROVITEC 1431
14" Colour Monitor, RGB Input. (as used in BBC programmes) FREE Interface Lead. **£215** (carr. £7)

- **KAGA RGB** 12" Medium Resolution Colour **£219** (Carr. £7)
- **KAGA RGB** 12" High Resolution Colour **£259**(carr. £7)
- **BNC** Connecting Lead **£3**
- **RGB** Connecting Lead **£5**

ZENITH 12" Green Monitor. Hi-resolution **£75** (£7 carr.)

CASSETTE RECORDER & ACCESSORIES

Top quality Slimline, portable Cassette Recorder for Computer use. Mains/Battery, operated with counter.

£24.00 (Carr. £1.50)

CASSETTE LEAD
For our Cassette Recorder to BBC Micro **£2.00**

CASSETTES C12 Computer grade in library cases **40p**

STACK PACK The unique Cassettes drawer rack system including 10 off C12 Computer Cassettes **£6**



BEEBPLOTTER

The Unique Graphic Tablet

Watford Electronics' BEEBPLOTTER will work with 32K BBC Micro. Connects to Analogue port. The unique design makes it accurate and simple to use. Attractively finished. The comprehensive booklet supplied describes its use in detail and shows some of the possible applications.

The special features include:-

* Works in all graphics mode and any colour selectable.
* Commands printed on Tablet and On-screen instructions.
* Special routines enable pictures to be quickly loaded from tape.
* Works with all operating systems and ECONET. Tape and Disc versions available.
* Large drawing area (32cms x 23cms).
* Maps, Pictures and Diagrams produced quickly and easily.
* Transparent tablet enables maps and diagrams to be copied directly from books.
* Commands include line, circles and rectangle drawings, infilling, full editing and an easy to use copy and move feature.
* Screen dump routines included for Seikosha and EPSON printers.
* Routines are included to allow user to incorporate pictures in their own programs.
* Designed by a professional teacher with educational uses in mind.

ONLY **£80** (£3 carr.)

READY-MADE LEADS for BBC

CASSETTE LEADS 7 pin DIN Plug to 5 pin DIN Plug + 1 Jack Plug	**£2.00**
to 3 pin DIN Plug + 1 Jack Plug	**£2.00**
to 7 pin DIN Plug	**£2.50**
to 3 Jack Plugs	**£2.00**
6 pin DIN to 6 pin DIN Plug (RGB)	**£2.50**
Monitor Lead, BNC to PHONO	**£3.00**

Disc Drive to BBC Micro Power Lead
Single: **£3.00** Dual **£3.75**

MISCELLANEOUS CONNECTORS

	Plugs	*Sockets*
RGB (6 pin DIN)	**30p**	**45p**
RS423 (5 pin Domino)	**30p**	**40p**
Cassette (7 pin DIN)	**25p**	**65p**
ECONET (5 pin DIN)	**15p**	**25p**
Paddles (15 pin 'D')	**£1.10**	**£2.15**
Disc to BBC Power Plug 6 pin	**70p**	-
Disc Drive Power Plug 4 pin	**60p**	-

★ SPECIAL XMAS OFFER ★

Microvitec 1431 MONITOR ~~£225~~ £209
Microvitec 1451 MONITOR ~~£370~~ £319
KAGA I MONITOR RGB ~~£219~~ £205
Zenith 12" Green MONITOR ~~£75~~ £72

TEACH yourself to TOUCH-TYPE

Thousands of people have already benefited from LISTEN & LEARN touch typing. You could be one of them in just 10 days. You progress at your own speed through step-by-step recorded instructions and carefully prepared exercises. Big keyboard diagrams help you learn to use all your fingers. The package includes: 2 specially recorded cassette tapes; Easy to use Flip Chart; 17 Keyboard diagrams; Professional typing exercises; Full explanatory text. An ideal Christmas gift.

Only £6.95

13 ROM SOCKET BOARD

Are you wondering where to fit new ROM based software inside your computer in addition to the BASIC, WORDPROCESSOR, DFS, and FORTH ROMS? Then our add-on 13 ROM Socket Board is the answer. Simply plugs into one of the four ROM sockets currently available in BBC Micro. There are only 4 solder connections to be made. Full instructions are supplied.
Our 13 ROM SOCKETS BOARD enables the **User to increase the Sideways ROM capacity** the basic four sockets on the main board upto the full SIXTEEN capable of being supported by current operating systems. In addition the board is designed with the facility to hold upto 16K RAM, which when switched into operation is automatically selected by any WRITE signal to the Sideways ROM area. This gives the User the ability to write a utility or language and upon pressing break have the utility or language up and running (new ROM software can be developed and tested in situ.)
The Board gives the User, plenty of freedom to explore the possibilities of the new paged ROMs due in the coming months and offers them the chance to develop their own.
All essential lines are buffered and the Board meets or exceeds all timings for operation in the BBC Microcomputer. When fully populated, the ROM Board consumes less than half the recommended maximum current limit.

Supplied ready-built and tested complete with fitting instructions.

ONLY £29.95 (carr. £1)

EPROM for the BBC MICRO & 13 ROM SOCKET BOARD

	1+	25+
2764-250nS	£4.20	£3.75
27128-250nS	£18	£13
27128-400nS	£16	£14
8271	£36	

CMOS RAM for the 13 ROM SOCKET Board

6116-150nS (2K)	**£3.40**
6264-150nS (8K)	£30.00

EPROM PROGRAMMER for BBC MICRO

At last! – the EPROM Programmer for BBC Micro Computer from WATFORD ELECTRONICS that will suit both your pocket and all your requirements. Programs all popular types of EPROMS from 2K bytes up to 16K bytes – **2716 — 2516 — 2532 — 2564 — 2764 — 27128.**
This extremely powerful system is designed for your needs of TODAY & TOMORROW! – BBC Basic programs can be copied into EPROM and subsequently re-loaded faster than from a disc! Suitable for both hobbyist and professional users!

Just look at these features:

● **COMPLETELY SELF CONTAINED** – Housed in its own sturdy case – Uses its own Power Supply – Connects directly to the 1MHz Bus – Simple and Safe!
● **FULL SOFTWARE SUPPORT** – Comes complete with simple to use ROM based software – Facilities include Varification, Reading, Virgin Testing, Writing, Editing, Saving, Loading and more! NOTE!! – This software does NOT simply comprise hastily prepared routines to get you going, but is a professional, purpose designed applications package.
● **ACORN BUS COMPATIBLE** – Use of the 1MHz connection complies with all Acorn addressing recommendations – That means you can still add-on such things as the TELETEXT, IEEE 488 and PRESTEL Adaptors without having to disconnect everything.

You don't need just any Eprom Programmer – you need **WATFORD ELECTRONICS** EPROM PROGRAMMER System.

ONLY **£89** (£2 carr.)

(Price includes software in ROM and Manual)

BEEBMON

A ROM based machine code Monitor for BBC Micro. It enables machine code programs to be debugged and altered easily and quickly. Being a ROM, its commands are always readily available and occupy no user memory. Appears to take no base page and only one page of relocatable workspace (256 bytes) and no more anywhere in RAM. Beebmon can do more than any other machine code monitors currently on the market. The special features include facilities like: TABULATE, MODIFY, FILL, COPY, COMPARE, SEARCH (HEX & ASCII) CHEKSUM, DISASSEMBLE, RE-LOCATE and by Emulating the 6502 processor, SINGLE STEP, BREAK POINTS ON READ/WRITE/EXECUTE OF LOCATION also BREAK POINTS ON A, X & Y REGISTERS are provided. HAS WINDOWS INTO MEMORY & TEST WINDOWS. All this and more for only: **£25**

BBC LIGHT PEN KIT

All parts available as per Acorn User's 'SHINE A LIGHT' Light Pen article.

Kit Price: **£8.95**

BBC LIGHT PEN

A ready-made Light Pen for BBC Micro. Enables you to produce drawings on your own TV/MONITOR screen. Supplied complete with Software Cassette and instructions.

ONLY: £17

WATFORD ELECTRONICS

Continued →

★ THE ULTIMATE ★ BBC MICRO DFS

by Watford Electronics

Highly acclaimed at the Acorn User Show. What do the independent press say?

Good Value for Money – Beebug Aug. '83
A very worthwhile package – The Micro User Sept. '83

Without a doubt, the most sophisticated DFS Software yet written for BBC Micro Computer. This powerful new DFS is fully compatible with ACORN DFS yet has much increased power due to additions, carefully designed to make life easier in normal use. It consists of over 14K of efficiently written machine code. It is entirely self contained and so does not require a utilities disc to function.

* The system can either use the ACORN standard 31 files per disc side or DOUBLE THE CAPACITY to 62 files. The size is selected at formatting time. Copying between discs with different catalogue sizes works perfectly normally.
* A FORMATTING PROGRAM is built in, permitting formatting to 35,40,80 track formats with either 31 or 62 files. Since the formatter is built in to the DFS it can be used without affecting whatever program you are using.
* A DISC VARIFIER is also built in. This checks the internal checksums on each sector to identify any corrupted data. This is extremely useful when saving valuable data as it shows faulty discs quickly and easily. Again it does not affect the program you are using.
* A built in DISC SECTOR EDITOR gives a screen window onto the disc enabling detailed editing of any byte on the disc. This is very useful for recovering accidently deleted files and can save weeks of work.
* A double step mode allows the user of 80 TRACK DRIVES TO READ 40 TRACK DISCS. This mode is software selected for each drive individually, thus allowing a 40 track disc to be copied onto an 80 track one very easily. THIS ELIMINATES THE NEED FOR EXPENSIVE SWITCHABLE DRIVES.
* A WORKFILE function sets the name to be used when the null filename is issued. This allows a program to be edited and repeatedly saved having only typed its name once.
* When using LOAD, CHAIN, etc. it is possible to specify an ambiguous filename. This will result in the first file whose name matches the specification being used. This saves typing the end of a filename that you know is uniquely identified by its first few characters.
* Two commands exist to simplify the transfer of programs from TAPE TO DISC. These load the file to &1200, switch off the disc system and then move the file to its correct load address; thus saving a lot of complicated programming. This command can be used to load files up to 27K5 long.
* An advanced COPY command is included which will prompt the user, requesting whether to copy each file.
* RENAME has been extended to allow the use of ambiguous filenames. This allows you to change BERT1, BERT2, BERT3 to FRED1, FRED2, FRED3 with only one command.
* OPENOUT has been improved to give you fewer annoying 'Can't extend' errors, as it automatically picks the biggest space on the disc in which to put a file. A SPACE command lets you know how much space *COMPACT could create before you waste time doing it.
* 1.75K of RAM can be taken over from the DFS for your large BASIC programs while still retaining LOAD, SAVE and *CAT and other simple commands.
* Comprehensive and clearly written Manual (available separately) gives the user a complete package deal.
* Fully compatible with BBC TELETEX and TORCH Systems

DFS ROM only — £39
Complete Disc Interface including our highly sophisticated DFS ROM and fitting instructions — £85
Comprehensive and clearly written DFS MANUAL. (P.S. This manual will only be sold to those who purchase our DFS.) — **£7.50** (no VAT)

P.S.
We will exchange your existing ACORN DFS or AMCOM (PACE) DFS for the highly superior Watford's DFS ROM for **£35**

ONLY THE BEST AT WATFORD

BBC FORTH on Cassette
Follows FORTH-79 standard and has fig-Forth facilities – Runs faster than BBC BASIC. ONLY **£13**
FREE 70 page manual and a Summary card.

BBC FORTH TOOLKIT
Adds many more facilities to the above BBC FORTH. Supplied complete with 64 page manual. Only **£9**



This space is reserved for yet another of our ROM based software for BBC Micro. For details please read our advert in the next issue of this magazine.

Computer Concept's Firmware

BEEB-CALC — **£33**
A ROM based spreadsheet program, like wordwise this firmware is fast and simple to use – yet is a powerful spreadsheet analysis program, considerably better than the original 'calc' program – full floating point maths. Works in 40 or 80 column screen modes – variable column widths. Works with either cassette or disc. This ROM coupled with Wordwise can turn your micro into an ideal small business machine.

DISC DOCTOR — **£26**
A sophisticated Disc Utility ROM with many useful commands. (For detail description please refer to Computer Concept's advert in this magazine.)

TERMI — **£26**
Computer Concept's Terminal Emulation ROM

Wordwise
Without doubt a very sophisticated piece of software for the BBC Micro. It has all the features of a professional word processor yet is easy to use.
SPECIAL XMAS OFFER: only £32

DISASSEMBLER
Will generate fully labelled assembly listings of any machine code program. Data is automatically differentiated from code and displayed together with its ASCII equivalent. Assembly listing can be saved in *EXEC format and subsequently incorporated into user programs.
Cassette: **£6.95**
Disk: **£8.95**

EMULATOR
An extremely powerful and flexible machine code interpreter. Allows you to write and debug machine code as easily as BASIC. Features single step, breakpoint register display, edit modes, etc.
Cassette: **7.25**
Disk: **£9.25**

VIEW Acorn soft's Wordprocessor ROM. — **£52**



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Simply phone your order through. We do the rest
(0923) 50234)

FORTH ROM for BBC — £39
This superb (FIG FORTH) compiling language now available in ROM. Simply plugs into one of the ROM Sockets. Manual included.

GEMINI'S BUSINESS SOFTWARE
Written by professional Chartered Accountants and coded by competent programmers. Ideal for small and medium sized companies. Now available from stock.

Cashbook Accounts	£52
Final Accounts	£52
Invoices & Statements	£17.25
Commercial Accounts	£17.25
Mailing List	£17.25
Database	£17.25
Stock Control	£17.25
Home Accounts	£17.25
Beebcalc Spreadsheet Analysis	£17.25
Beebplot	£17.25

N.B. All the above Gemini software is on tape. For Disc Based (40/80 track) please add £3.

BOOKS (No VAT on Books)

30 Programs – BBC Micro	£4.95
30 Hour BASIC (BBC Micro)	£6.00
100 Programs for BBC Micro	£6.95
6502 Application Book	£10.25
6502 Assembly Lang. Programming	£12.50
6502 Assembly Lang. Subroutines	£11.80
6502 Software Design	£10.50
A young persons guide to BBC Basic	£4.50
ACORN ATOM Magic Book	£5.50
Advanced 6502 Interfacing	£10.95
Advanced 6502 Programming	£10.50
Assembly Lang. Programming for BBC	£8.95
Advanced Programming Techniques for the BBC Micro	£7.95
Advanced Programming Techniques for the BBC Basic	£7.95
Assembly Lang. Prog. on BBC Micro	£7.40
BASIC Programming for BBC Micro	£5.95
BBC Forth	£7.50
BBC Lisp	£7.50
BBC Micro An Expert Guide	£7.50
BBC Micro Graphics and Sound	£6.95
BBC Micro ROM PAGING System Explained	£2.95
BBC Micro Revealed	£7.95
BBC Micro Instant Machine Code including Software Cassette	£34.00
Creative Adventure Programs on BBC Micro	£6.95
36 Challenging Games for the BBC Micro	£5.95
Creative Graphics Cassette (Acornsoft). Has 36 graphics programs	£8.95
Creative Graphics on BBC Micro	£7.50
Complete Programmer for BBC	£5.95
Discover BBC Machine Code	£6.95
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Easy Prog. for BBC Micro	£6.50
35 Educational Programs for BBC Micro	£6.95
Further Prog. for BBC Micro	£6.90
FORTH Programming (Sams)	£12.50
Functional forth for the BBC Computer	£5.95
Games on your BBC Micro	£2.95
Games BBC Computer can Play	£6.95
Getting Acquainted/Acorn ATOM	£7.95
Graphs & Charts on BBC Micro	£7.50
Intro to Micro Beginners Book (3 Ed.)	£9.90
Introducing the BBC Micro	£5.95
Let your BBC teach you to program	£6.75
LISP	£9.25
Micros in the Classroom	£4.90
Practical Prog. for BBC & ATOM	£5.95
Programming the 6502	£10.75
Programming the BBC Micro	£6.95
PASCAL	£9.25
Logo Programming	£8.95
Mastering VISICALC (Sybex)	£11.95
Structured Prog. with BBC BASIC	£9.50
The BBC Micro Book, BASIC, SOUND & GRAPHICS	£7.40

NEW DISC-FIX ROM

This ROM is an integrated, menu-driven DISC MAINTENANCE PACKAGE. Using simple menu selections, with intelligible prompts for any input required, the user can recover data from damaged discs. Facilities include:-

- Full screen editing of sectors on the disc.
- Sectors can be found by file name or sector number.
- Files and sectors can quickly and easily be dumped to a printer for examination and possible subsequent modification.
- COPY: blocks of data can be copied from any point on the disc to any other point. Blocks can be as small as one byte and can be transferred anywhere in a sector.
- SEARCH: The disc can be searched for any string, starting and finishing at any designated sector.
- VERIFY: Any block of sectors can be checked for their validity.
- FORMAT: Any track or group of tracks can be individually formatted to Acorn or Watford DFS standard.
- INSERT: Allows the manual creation of new directory entries to allow "undeletion" of files.
- BACKUP: This is similar to normal DFS backup but allows recovery after a disc error.

Completely compatible with both Acorn and Watford Disc Filing Systems. Instruction manual supplied.

Price **£19.00**

TINY PASCAL (in 16K ROM)

PASCAL-T is capable of compiling source PASCAL into a compact very fast threaded-interpreters-code. Full editor and disc support are included. Comprehensive documentation supplied **£59**

EDUCATION Software

JUNIOR MATHS PACK (32K) £6.95
Makes learning fun for 5-11 year olds. This package consists of 3 programs (menu driven) that increase in difficulty as your child becomes competent. A very good supplement to standard educational methods.

MATHS TRANSLATIONS £5.50
This package explains how to translate Triangles and Quadrilaterals, moving these geometrical shapes on a grid. It goes step by step through the concepts and the matrix calculations involved. Excellent software.

WORLD GEOGRAPHY (32K) £7.00
Beautifully drawn Hi-Res colour map of the world illustrates and aids this graded series of tests on capital cities and populations of the world.

WORDHANG £7.80
(Age 7-13). A word guessing program based on the well known Hangman game. Uses full colour graphics. Complete with 260 words and the facility save your own list of words.

WORLDWISE £7.80
(Age 7-15. Two constructive geography programs allowing children to build detailed data bases covering both the UK and the world. Encourages children to refer to atlas and reference books. Save the database anytime.

ANIMAL/VEGETABLE/MINERAL £4.95
(Age 7-13). Provides an opportunity for children to teach the computer to differentiate between objects. The program tries to guess the object the child has thought of, using personalised responses like Mmm . . . I am thinking.

BRITISH GEOGRAPHY £6.95
Teaches a child the locations of Cities and Ports using directional keys.

CAROUSEL £5.50
Aimed at junior school age. Sequences of colours and sounds teaches a child to concentrate.

HAPPY NUMBERS £7.80
(Age 4-6). No reading skills are required to use this colour graphics number recognition and counting program. Children build patterns of flowers corresponding to figures, quickly learning their significance.

INTRO TO ARITHMETIC £10.45
4 programs – Additions, subtractions, multiplications and divisions. Help stage, moving graphics and colours. Worksheet produced at the end of program. (5-7 years old).

BBC JOYSTICKS

Two versions available:

SINGLE: Player type	**£7.00** each
TWO Players type	**£11.50** per pair

NEW LAUNCH

★★★ PENGO ★★★

One of the most sophisticated full colour, 100% machine code games software. This arcade game will give hours of fun. You (Pengo) are being harassed by the devouring Snobees (Snow Beasties) whose diet is the Ice-cubes and an occasional juicy Pengo!! Your only means of survival is to hurl the ice-cubes at the marauding snobees and crush them into the snow. Beware, as you crush them to death the remaining snobees turn even more vicious. Each act will bring a new species, even more agressive!!! All is not lost; Bonus points are won by lining up the three indestructable DIAMOND cubes. Progressive levels of difficulty. Bonus Pengo at 30K points. A MUST for all BBC Micro owners.

Only: £7.75

VOLTMACE'S DELTA 14 Hand-set

(Highly acclaimed at the Acorn User Exhibition)
Save your BBC Keyboard from a games bashing with our precision, smooth, sprung return 'Delta 14' Joysticks which has a built-in 14 Button Keypad. The hand set is Acorn Soft compatible and will work as a Joystick and two Fire buttons. Adding the ADAPTOR BOX will enable the use of all twelve Buttons (plus two repeated).
A user friendly, Keyboard to Keypad transfer program allows you to assign any Keyboard Key to either Keypad button or Joystick direction. The program also allows you to adjust sensitivity on the Joystick and conversions can be saved in a library which already contains some Acorn-Soft conversions.

Price: 'Delta 14' Hand set		£11.25
ADAPTOR MODULE		£11.95
TRANSFER PROGRAM	Tape	£5.15
	Disc	£7.75

PLINTH FOR BBC MICRO

Protect your micro from the weight of the heavy TV/Monitor. This sturdy plinth is attractively finished in BBC colour. It can be used to support a monitor or a printer. The micro slides underneath comfortably. A must for every BBC Micro owner, specially for those who have to move/open their computer frequently.

Price: £10 (carr. £1.50)

PLINTH FOR PRINTERS

Keeps your desk tidy. Place the printer on the plinth and the paper underneath. Finished in BBC colour.

£10 (carr. £1.50)

NEW NEW NEW

Yes it's here. . . the ROM you have been waiting for!!!

BEEB PRINTER ROM

Are you fed up with not being able to unravel your printer manual and use all those features you paid for? Need sensible paging for use in the creation of booklets? Then you certainly need our Beeb Printer ROM.
A machine code printer utility in ROM.

* 'Single' key operations replace control code sequences for underline, front and size selection, paper movement, etc. Up to 30 come pre-defined, without effecting normal fn key usage.
* Automatic fanfold page margins. Puts gaps in listings. PRINTed text etc to skip the folds. The gap size alternates to minimise paper wastage when using binders.
* Form feed and related commands, made available on ALL printers. Can also provide a left margin.
* User defined characters embedded within text are printed as on VDU.
* * Commands select option for GP100, STAR, NEC, MX/FX, LP VII/DMP100, DMP200. Operates with parallel interface printers and is turned on by *FX5,3.

Supplied complete with Manual.

Price: £24

(When ordering, please specify the make of printer you have.)

ATTACHE CARRYING CASE for BBC Micro

These Attache Carrying cases are attractively finished in mottled antique brown leatherette. An ideal and very safe way to carry your BBC Microcomputer. £12 (£2 carr.)

GAMES SOFTWARE (PROGRAM POWER)

ALIEN DESTROYER	**£6.95**
ANDEROID ATTACK (C.Concept)	**£6.95**
CHESS	**£6.95**
COWBOY SHOOTOUT	**£5.95**
CROACKER	**£6.95**
Escape from Moonbase ALPHA	**£6.95**
GALACTIC INTRUDER	**£6.95**
GALACTIC COMMANDER	**£6.95**
KILLER GORILLA	**£6.95**
LASER COMMAND	**£6.95**
MUNCHYMAN	**£5.95**
MASTERMIND	**£4.95**
MOONRAIDER	**£6.95**
MICRO BUDGET	**£7.95**
SWOOP	**£6.95**
SEEK	**£5.95**
747 FLIGHT SIMULATOR	**£7.75**

LEVEL 9 ADVENTURE GAMES

COLOSSAL ADVENTURE. The classical mainframe game "Adventure" with all the original puzzles plus 70 extra rooms. £8.65

ADVENTURE QUEST. Through forest, mountains, desert, caves, water, fire, moorland and swamp on an epic quest vs tyranny. **£8.50**

SNOWBALL: Save a 7000 location colony starship in 2302 AD. £8.50

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WATFORD ELECTRONICS

Dept. BBC, Cardiff Road, Watford, Herts, England.
Telephone: 0923 40588/37774. Telex: 8956095

Supercar test for Z80 processor

FERRARIS and Beebs got together for the recent Motorfair in London. Compute-a-Ferrari demonstrated a BBC micro-driven system which keeps detailed descriptions of cars for sale, and buyers' requirements. David Hunt, who is sponsored by Acorn in Formula 3 racing, hopes to extend the idea to cover Porsche, Lotus and Aston Martin cars.
The system uses custom software and is based around a Beeb running a Z80 second processor which is on field trial with the company.

Disc Wordsworth

A DISC version of the Wordsworth word processor features a help command and viewing in an 80-column format. Another neat idea is to be able to halt the printer in the middle of dumping a document to alter the text.
The disc version costs £19.50 (40 or 80 track) and the cassette £17.50 from Ian Copestake, 23 Connaught Crescent, Brookwood, Woking GU24 0AN.

Meal menus

FOOD is now on the software menu with *What's to eat?*, a database program which can plan 20,000 combinations of three-course meals. It will also display ingredients and produce a shopping list.

The program runs on a model B from cassette (£9.95) or 40-track disc (£12.95). Shumwari Associates, 12 Marlin Court, Marlow, Bucks SL7 2AJ.

H&H games

CHEMIPLANT is a chemical plant simulation game, and one of two arcade games from H&H Software. The other is *Looney Lift*. A third release adds to the company's educational range and is called *Story*.

Shiva teaches

SHIVA Publishing is producing a series of 11 cassettes with supporting books.

The first four tapes to be released, on numeracy and logic, each consists of five programs for the model B, with versions for the Electron planned.

The packs cost £14.95 each, and cover addition, subtraction, and composition of numbers.

Game change

■ THE new series of *The Adventure Game* will not be broadcast in the autumn, as was stated in the October issue of *Acorn User* – but it will go out in the spring.

Putting the sun on trial

SOLAR energy is at the heart of a revolutionary form of heating – and BBC micros are a vital part of the experiment.

Peterborough Development Corporation has built three homes, whose unique feature is that the whole of the south facing wall and roof are covered in glass to trap heat. The warm air generated is then used to heat the house and provide hot water using a heat exchanger.

The ideas are not new, but Peterborough claims the microprocessor-controlled system is the most advanced in the world, and the first practical installation in Britain.

BBC micros are used to do the initial processing for 100 data channels in the heating system. These gather information from heat sensors, mechanical pumping equipment, gas and electricity meters, temperature, hot water flow, and last, but not least, the weather conditions.



Chris Martin checks the BBC micro

The data is fed into the BBC micro for checking and initial processing before being passed on to a mainframe computer at the Polytechnic of Central London.

Two houses will be occupied by families, while a third is occupied by the researchers and used to store the BBC micros and other monitoring equipment.

The researchers estimate that about half of the energy houses use could come from the sun – and buildings account for about half of the energy used in Britain each year.

The system is the brainchild of Dr John Littler from the Polytechnic, who expects the experiment to provide valuable lessons which will have a direct effect on the future of home heating.

Chris Martin from the Polytechnic is in charge of the monitoring equipment and data processing, and expects to be able to make the findings available to other researchers in the field.

An EEC grant of £50,000 is being used to fund the study.



The glass-encased walls

Beeb-Apple networking

PICONET allows BBC micros to communicate and share disc drives on an Apple II computer in a simple local network system.

Each BBC is fitted with software in a sideways ROM and a linking cable, while the Apple loads the system software from disc. Then Basic programs can be loaded into the Apple and sent to a Beeb on the network.

Each BBC micro on the network (called a station) can catalogue the Apple disc, and load or save Basic or machine code programs. Data is transferred between machines at 9600baud along the four-wire cable.

Up to 10 terminals can be connected and files 20k long handled by the Apple.

Piconet is designed for use in schools and means teachers are able to load a program in from disc on the Apple and download it to every BBC cassette-based machine (with a series 1 operating system).

Each Beeb costs £34.95 to connect to the system, and the kit for the Apple is £64.95. A manual alone costs £3 from Decode Logic, 8 Craigstewart Crescent, Alloway, Scotland. Tel: (0292) 43492.

Computers on Radio 4

BBC radio 4 is to start up a computer magazine programme next January.

A name has yet to be fixed, but the series will aim to cover as wide a range of computing interests as possible. There are no plans to make it machine-specific, or to broadcast software.

Trevor Taylor, the producer, hopes to reach a million listeners, from information technology specialists to home computer hobbyists.

Transmission dates have been fixed on Saturdays, starting on January 14 through to March 17 at 5pm on long wave. Repeats will go out on Tuesdays starting January 17 at 11pm on VHF.

There are six programmes in the first series, each lasting 25 minutes.

■ Patrick Titley, director of the BBC's recent *Live Micro Show* and part of the *Making the Most of the Micro* series has moved on to look after *The Great Egg Race*. Patrick is known to be hooked on his Beeb, so expect to see the natty micro turning up there also.

GAME TO EARN £1,000?



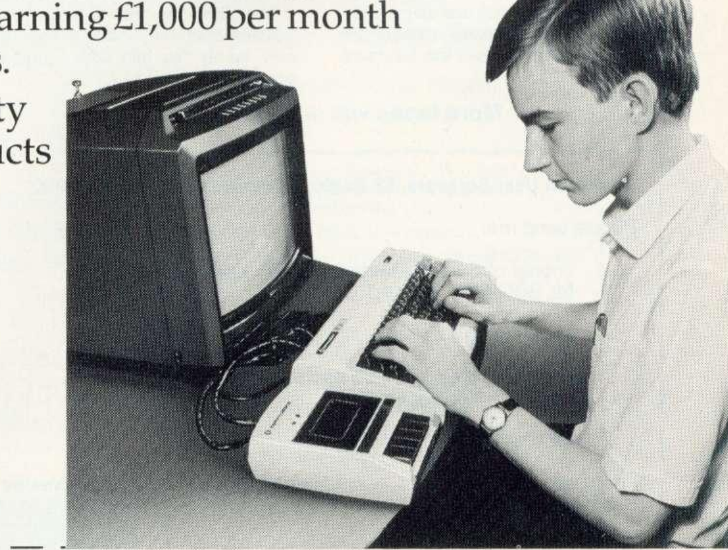
Just one good marketable game, educational or strategic simulation program could earn you, as author, up to £1,000 as a lump sum if you sell the rights in it to Logic 3 – Britain's fastest-growing company in home computer software.

Or keep the copyright, take a royalty on sales, and maybe earn even more in the long run – our best selling author is currently earning £1,000 per month in royalties.

Logic 3 is now looking for new high quality entertainment and educational software products to run on the leading home computers – particularly Acorn Electron, Commodore 64, Sinclair Spectrum and Dragon.

Write or phone Andrew Goltz at Logic 3, Mountbatten House, Victoria Street, Windsor (07635-57181) to know more.

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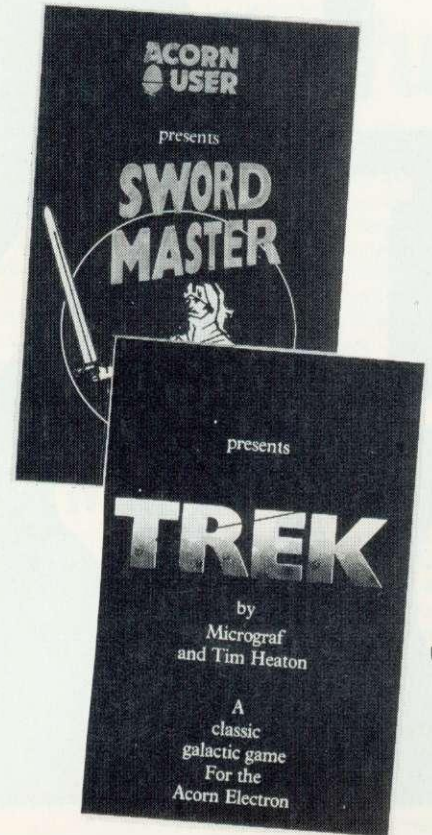
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£7.95 inclusive
for 32k BBC micro
or Electron
(joystick or keyboard)
Two-player game

£7.95 inclusive
for Electron
or
32k BBC micro
(joystick or keyboard)
Uses voice synthesis

Acorn User presents two high-quality games on cassette for your micro which put you at opposite ends of time. Developed, produced and tested by Micrograf.

Sword Master by Ken Worrall is based on the fencing rules written in 1190 by Herman von Salza for the Deutscritter Order of Teutonic Knights. It features full colour, machine code animation of a sword duel between the players shown on screen as knights.

Full instructions, music, sound effects, player rankings (from greenhorn to Swordmaster) and a roll of honour (which can be saved) and all included. The game also closely reflects the rules, style and dress of the Deutscritter Order.

Trek puts you in charge of a Starship with the task of wiping out an alien fleet. It's an excellent adaptation of the classic game with 7 screen displays, 3 on-board computers and 2 weapon systems.

Versions have been written for BBC micro and Electron to use both machines to their full. The BBC tape uses voice synthesis (if the chips are fitted).

The game has been extensively developed from Tim Heaton's Trek III. It now barely fits into 32k – and the graphics are in mode 7.

More tapes will soon be released.

To: **Acorn User Software, 53 Bedford Square, London WC1B 3DZ.**

Please send me:

......copies of **Sword Master** at £7.95 each for BBC (32k Series 1 OS) £.......

......for Electron £.......

......copies of **Trek** at £7.95 each for BBC (32k Series 1 OS) £.......

......for Electron £.......

I enclose a cheque for £........ made payable to Addison-Wesley Publishers Ltd.

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Address ....

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THE Microfair travelling exhibition of electronic aids for the handicapped carried more than 100 products based around the BBC micro. One simple device was the Micro Mike, a modified CB microphone which gives voice control over a range of software.

The fair is due to make its final appearance at the Scottish Health Service Centre from November 28 to December 2. An excellent booklet has been produced to accompany the event. Details from Ed Wilson, Handicapped Persons Research Unit, 1 Coach Lane, Newcastle-upon-Tyne Polytechnic. Tel: (0632) 664061.

Versatile keyboard

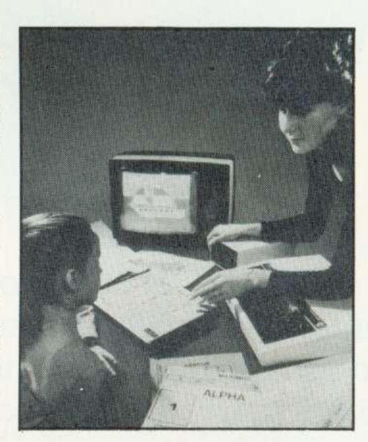
THE Concept keyboard is a flat, pressure-sensitive device which takes interchangeable A4-size overlays. These can be changed to suit a particular program, with key size, shape, colour, position and legend appropriate to the application.

The keys can be made large enough to allow operation by visually or physically handicapped pupils.

The Concept keyboard can be used with any microcomputer, and is well suited for any educational application where the normal QWERTY keyboard presents difficulties.

The keyboard has an 8×16 matrix of touch-sensitive areas, each producing a unique seven-bit ASCII code which the programmer defines as required. A bleeper with on/off control, and two additional user-dedicated touch pads, are also provided.

Contact Lesley Stubley, Star Microterminals Limited, 22 Hyde Street, Winchester, Hampshire, SO23 7DR.



■ Dr Thomas Vincent, whose article readers may remember from the July issue, exhibited six pieces of software at the Microfair.

Three of these used the Concept keyboard, in conjunction with speech output from the micro.

Data capture device

THE Oasis MADC12 is a data acquisition device designed to use the BBC micro's processing power.

It comes complete with a menu-driven software package, and features an analogue to digital converter with 12-bit resolution.

Oasis also makes an EPROM programmer for use with disc-driven Beebs. The company claims its operating system software is foolproof and will blow 24- or 28-pin chips from 8k up to the latest 256k versions.

Oasis Electronics is at University Village, Norwich NR4 7TJ.



The neatest and best disk option ever.

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3″ – The new standard
Japan, home of the major disk drive manufacturers, has decided to make the new 3″ disks a standard. And no wonder. Not only are they strong and easily stored, they give 100K per side, and you simply flip them over in the same way as a music cassette. The small light on the casing reminds you which side you are using.
The disk is totally encased in rigid plastic, with no exposed surfaces, is easily inserted with one hand and simply removed by pressing the eject button. A unique feature of the new disks is a mechanical tab which prevents overwriting of precious data. And of course, you can switch it back when necessary.



Reliable and robust
The Hitachi boasts a brush-less direct drive motor, the best possible system for trouble free use. AMS-3 units simply run off the BBC power supply – they don't need their own supply and there's no need to worry about corrupt data.
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*Disk drives supplied by Hitachi Europe Ltd.

A+B Computing (Sept) **stated – "excellent manual"…"its simplicity of use must recommend the Hitachi 3″ drive to anyone about to purchase a disk drive"…"the microdisk is a marvellous change" Personal Computer News "protective sleeve and hard plastic exterior provide for greater protection"…"far more durable and easy to handle than normal drives"**

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Please send me by door-to-door courier:
______(qty) AMS-3 (S) single disk drives at £225 each with free disk.
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(Prices include EPROM, utility disk, cables, manual, VAT and delivery).
Please send me by post, if not with drives:
______(qty) double sided (100Kx2) disks at £4.95 each.
______(qty) packs of five at £22.50 per pack.
______(qty) utility EPROM at £15.
I enclose a cheque for £ ______
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MODEL REFERENCE	1302-1 Medium Resolution	1302-2 High Resolution
RESOLUTION	370 x 470 Pixels	580 x 470 Pixels
C.R.T.	14"	14"
SUPPLY	220/240v. 50/60Hz.	220/240v. 50/60Hz.
E.H.T.	Minimum 19.5kv Maximum 22.5kv	Minimum 19.5kv Maximum 22.5kv
VIDEO BAND WIDTH	6MHz.	10MHz.
DISPLAY	80 characters by 25 lines	80 characters by 25 lines
SLOT PITCH	0.63mm	0.41mm
INPUT: VIDEO	R.G.B. Analogue/ TTL Input	R.G.B. Analogue/ TTL Input
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(N.B. A Medium Resolution Monitor including VAT, lead, and carriage costs £187.39. A High Resolution Monitor including VAT, lead, and carriage costs £279.39.)

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AC 1

Landscape artist Peter Batty follows the seasons

A CHANGE OF SCENE

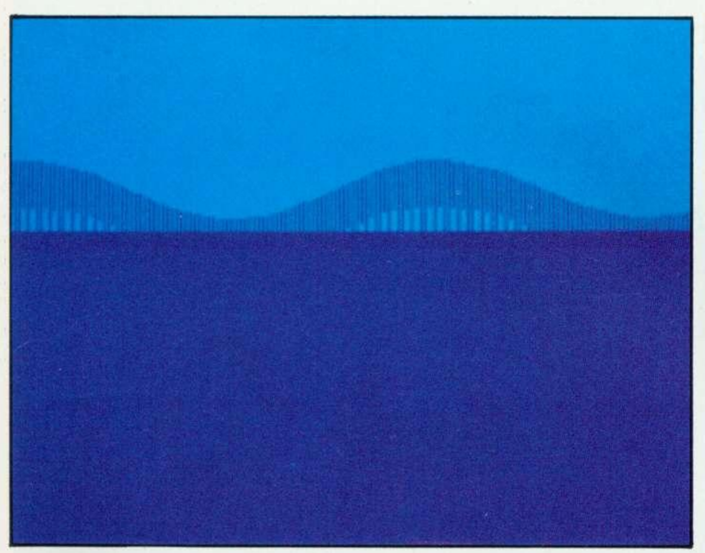
BUILDING landscape pictures represents a simple and effective introduction to three-dimensional graphics and computer art. Computer graphics are usually based on shapes and designs which, implying both depth and perspective, require tricky and time-consuming algorithms to remove hidden lines and surfaces. Although having depth, however, landscapes rarely contain much perspective and this makes it possible to generate powerful and evocative images without worrying about the complexities of three-dimensional co-ordinate geometry.

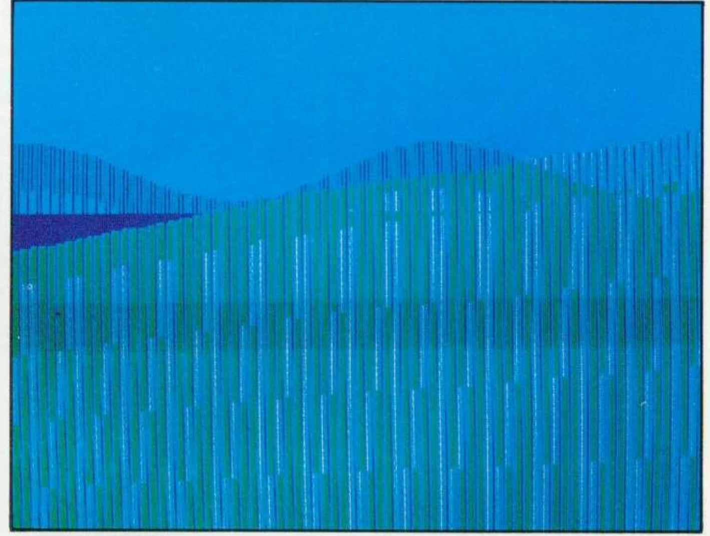
Landscape pictures are usually well-structured in terms of their back-, middle- and foregrounds, and this allows hidden lines and surfaces to be removed using the technique of plotting the picture from horizon to foreground. If you develop pictures in this manner, the program will reflect the 'temporal priority' of the various objects plotted. Here I'll show how these ideas can be used to create a three-dimensional picture based on typical landscape objects such as hills, lakes, fields and trees, constructed in turn using blocks of colour shaped by trigonometric functions such as sine waves and ellipses.

The program has a particularly simple structure. The distant hills are first over-plotted on the background sky, then a lake is drawn, followed by a middleground of hills, and finally a foreground of grassy fields is plotted one field over another. Each form is plotted using a procedure (PROCHILLS) which is varied to suit colour and shape. A winding road (PROCROAD) is then plotted from a point at the edge of the foreground and middleground to the bottom of the picture (see stages shown below). Finally, a number of trees are plotted from the back to front of the foreground. Each tree, first plotted by PROCTREE, is then displaced a little and replotted by PROCTREE or shaded by PROCTSHADE. This gives an impression of depth.

The colour-fill is achieved largely by using the triangle fill command PLOT85, and the tree-shading procedure operates under the dotted line command PLOT21. The structure of the main program (lines 100-500) is illustrated in figure 1 which shows the temporal priority of the various procedures as they create the screen image.

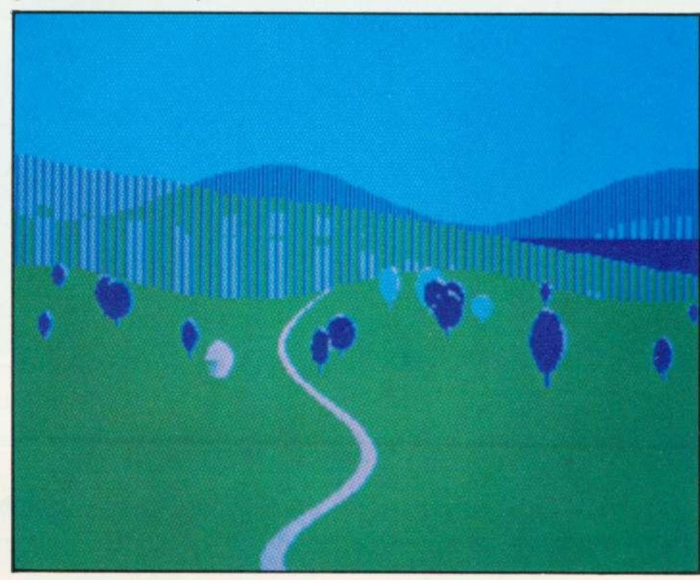
The complete program is presented in figure 2. First PROCHILLS (lines 610-750)

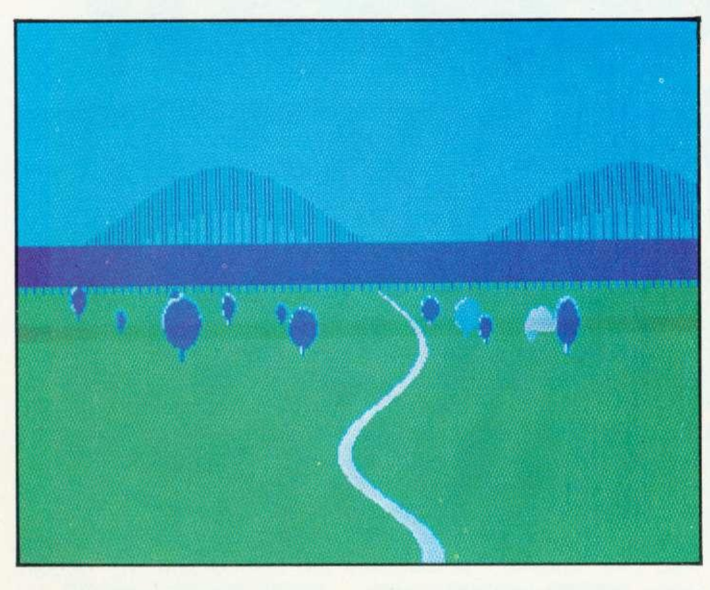
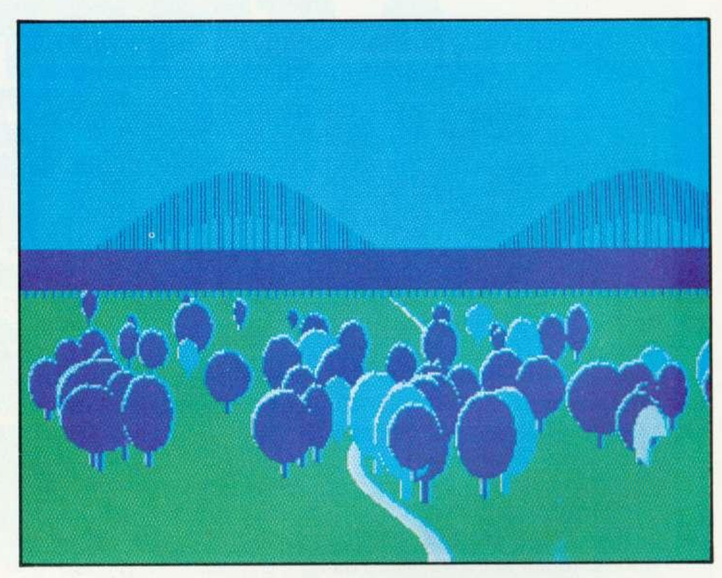
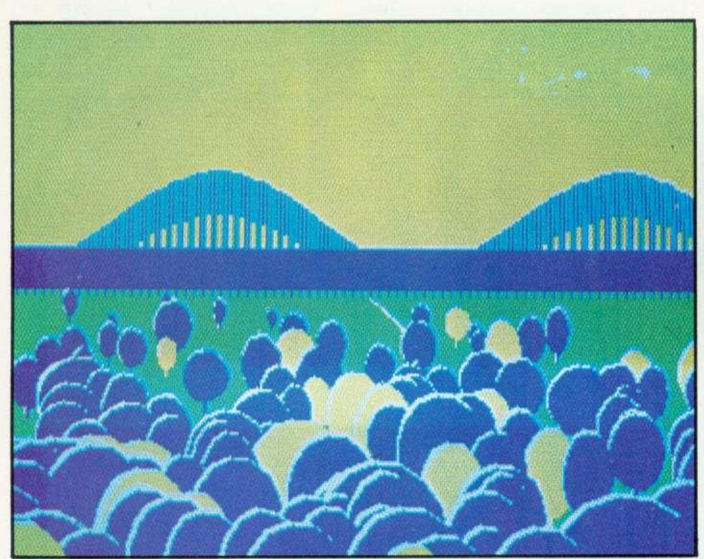
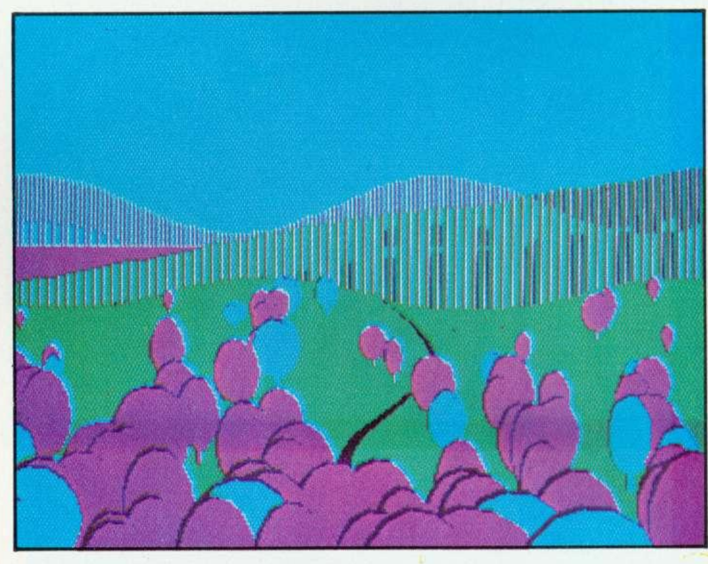
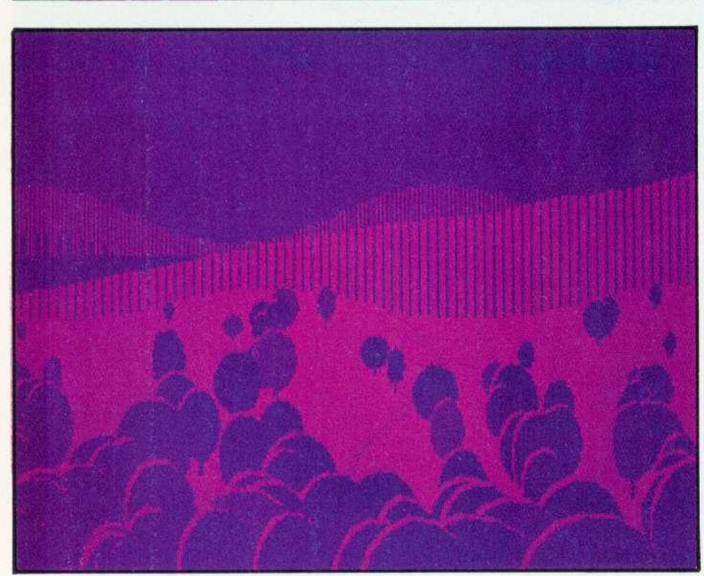
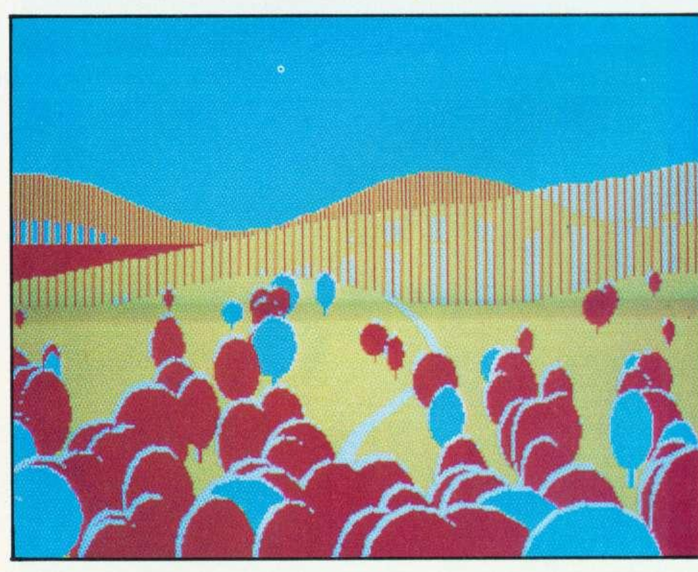




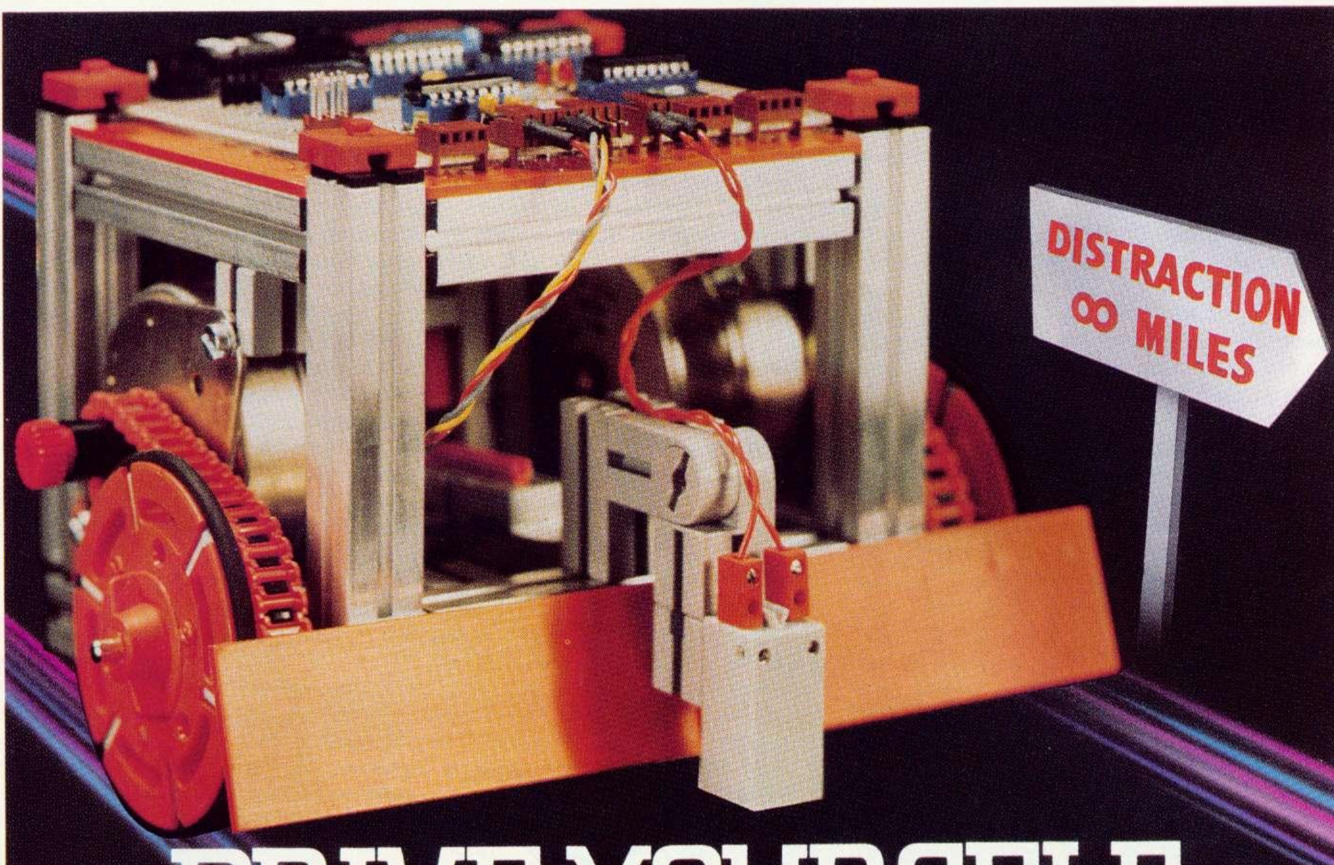
Four stages in producing finished landscape





Six seasonal landscapes (these are actual screen shots)

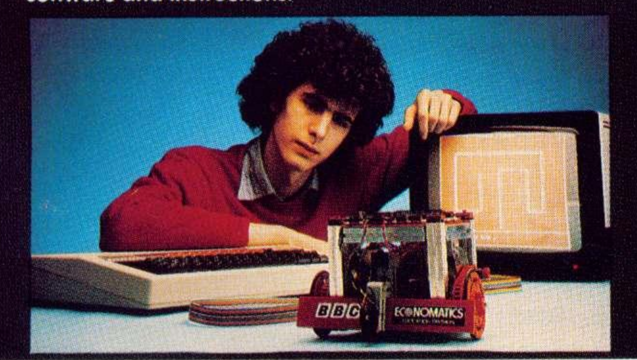


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The BBC Buggy is available from Acorn/BBC dealers and other major outlets.



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is used to plot a block of colour across the screen from the bottom to the back edge. The shape of this edge can be horizontal, upward- or downward-sloping or wave-like. In the case of the wave, this is based on the sine function whose co-ordinates are computed using a standard recursive formula based on sine addition rules.

The distant hills are always a wave form, the lake horizontal, but the shape of the middle- and foregrounds is determined randomly. High-order GCOL operators are used to hatch the distant hills and middle-ground as suggested by Peter Voke (*Acorn User*, May, 1983). PROCROAD (lines 770-920), is also based on a sine wave. It is here that the only admission to perspective in the whole program is given, for the road widens as it approaches the front of the foreground, being filled by the triangle fill routine.

The number of trees and their precise location is determined randomly. The general size of each tree is fixed in terms of its distance from the back edge of the foreground, but its precise size is determined randomly, thus easing the burden on introducing true perspective. Each tree is based on an ellipse which varies from a circle to a shape whose vertical axis can be twice its horizontal. In PROCTREE (lines 940-1090), the points of the ellipse are calculated using a standard recursive formula which alleviates the need for successive trigonometric function calculations, and thus increases speed.

Every tree is displaced slightly and re-plotted or shaded in a different colour. In PROCTSHADE and PROCLINE (lines 1110-1320), a simple shading technique based on plotting dotted lines of alternate colours is developed using co-ordinates of each ellipse at the lowest level of pixel resolution for the given mode. Each tree has a stem which is located clear of the road, and trees which are plotted over the border to the foreground are always solid, thus providing a frame to the picture.

A substantial degree of randomness is built into the program, so each landscape will be different in detail, if not in structure. The sine waves are chosen with different peak values. On average, one-sixth of the middle- and foreground shapes will be horizontal, one-sixth downward sloping, one-sixth upward sloping, while half will be wave-like. The thickness of the road varies slightly from one run to the next, while the number of trees plotted will vary between 1 and 150, changing the form of the landscape substantially. On average, five-sixths of the trees will be solid, one-sixth shaded, while of those which are solid 80 per cent will be blue, the rest cyan.

Many landscapes emerge from this program: flat, hilly, bare or well-wooded landscapes can result, with or without lake or sea features.

The last segment of the program (lines 520-590) changes the landscape colours using the VDU 19 command. Twenty changes are made which reflect the seasons. The initial landscape is a summer one, plotted in mainly blues/ green. This merges into autumn (yellow/red), then into winter (black/white) and in turn into spring and summer again (combinations of blues, green and white).

The best way to explore the full drama of these landscapes is to leave the program running and watch it for half an hour or so as new landscapes are generated. Page 24 gives a sample of what can happen.

The technique of overplotting or temporal priority is so obvious that it makes the generation of more complex landscapes within the program very simple. For example, the addition of many more 'lines' of hills, fields and forests could be accomplished by simply repeating PROCHILLS before PROCROAD is called. Further experimentation through varying the GCOL operators, the constraints on the shapes and sizes of trees and hills, and the methods of shading objects can lead to richer and sometimes bizarre scenes. Landscapes such as these provide a useful vehicle for exploring perspective and techniques for approximating such effects.

page 28 ▶

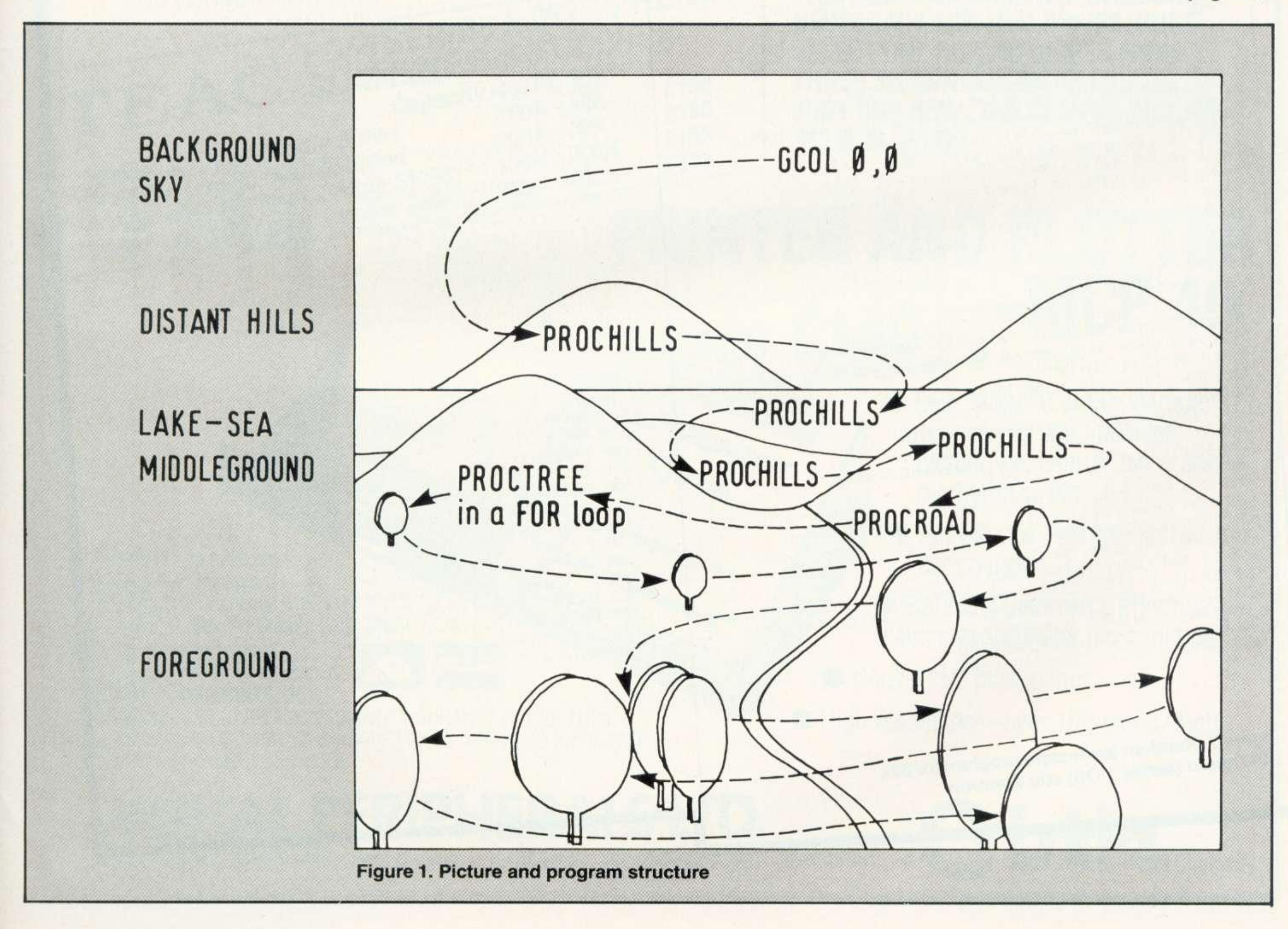


Figure 1. Picture and program structure

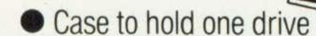
```
10 REM Random Landscapes
20 REM (C)Michael Batty
30 REM Acorn User, December 1983
40 MODE1
50 DIM YH%(64),OP%(4),CF%(1)
60 OP%(1)=143:OP%(2)=0
70 OP%(3)=179:OP%(4)=0
80 VDU19,0,6;0;19,1,4;0;
90 VDU19,2,2;0;19,3,7;0;
100 VDU5:CLG
110 :
120 REM This segment plots the distant hills,lake,
130 REM middle and foreground,then the road
140 K%=2-RND(3):N%=50
150 YS%=635+K%*RND(N%)
160 PROCHILLS(YS%,1,1,0,0)
170 YS%=YS%-(20+RND(N%))
180 PROCHILLS(YS%,1,2,0,1)
190 YS%=YS%-(20+RND(N%))
200 K%=2-RND(3):CK%=2-RND(2)
210 PROCHILLS(YS%,2,3,K%,CK%)
220 YS%=YS%-RND(N%/4)
230 K%=2-RND(3):CK%=2-RND(2)
240 PROCHILLS(YS%,2,4,K%,CK%)
250 PROCROAD(3,0)
260 :
270 REM This segment plots various sizes and
280 REM shades of tree from back to foreground
290 N%=100:INC%=0:M=RND(150)
300 KZ%=INT(RND(1)+0.5)
310 FOR II%=1 TO M
320 INC%=INC%+RND(1000/M):VDU29,0;0;
330 XL=RND(1279):IZ%=XL/20:YL=YH%(IZ%)-INC%+1
340 YT=(((YH%(IZ%)-YL)/YH%(IZ%))*N%+RND(20))*3
350 YH=YT/(2.0+RND(1)):XH=YH/(1.0+RND(1))
360 IF XH<4 THEN GOTO 330
370 IF POINT(XL-XH,YL)=3 THEN GOTO 330
380 IF POINT(XL,YL)=3 THEN GOTO 330
390 IF POINT(XL+XH,YL)=3 THEN GOTO 330
400 IF XH/YH<=1 THEN XB=YH*0.05 ELSE XB=XH*0.05
410 YT=YT/40:YB=-YH*1.4:ZC%=RND(3)
420 IF POINT(XL-XB,YL+YB)=3 THEN GOTO 330
430 IF POINT(XL+XB+YT,YL+YB-YT)=3 THEN GOTO 330
440 IF XL-XH<5 OR XL+XH>1275 THEN ZC%=1
450 IF YL-YH<5 THEN ZC%=1
460 PROCTREE(XH,YH,0,3)
470 XL=XL+YT:YL=YL-YT:T%=KZ%*ZC%
480 IF T%<=2 THEN PROCTREE(XH,YH,0,1)
490 IF T%>2 THEN PROCTSHADE(XH,YH)
500 NEXT II%
510 :
520 REM This segment switches the colours,
530 REM thus simulating the four seasons
540 FOR I%=1 TO 20
550 FOR II%=1 TO 5000:NEXT II%
560 READ COL0%,COL1%,COL2%,COL3%
570 VDU19,0,COL0%;0;19,1,COL1%;0;
580 VDU19,2,COL2%;0;19,3,COL3%;0;
590 NEXT I%:FOR II%=1 TO 15000:NEXTII%
600 END
610 REM PROCHILLS plots a wave or line of colour
620 REM constructing the back to foregrounds
630 DEFPROCHILLS(YS%,COL%,J%,K%,CK%)
640 GCOL OP%(J%),COL%
650 DT=RAD(10):TH=RAD(RND(360))
660 S=SIN(DT):C=COS(DT):SS=SIN(TH):CC=COS(TH)
670 SI=RND(100):YN%=YS%*CK%+(1-CK%)*(YS%+SI*SS)
680 MOVE 0,0:MOVE 0,YN%:YH%(0)=YN%
690 FOR I%=20 TO 1280 STEP 20
700 SN=SS*C+CC*S:CC=CC*C-SS*S:SS=SN
710 YN%=(YN%-K%*RND(5))*CK%+(1-CK%)*(YS%+SI*SS)
720 YH%(I%DIV20)=YN%
730 PLOT85,I%,0:PLOT85,I%,YN%
740 NEXT I%
750 ENDPROC
760 :
770 REM PROCROAD plots a winding road based
780 REM on a sine wave
790 DEFPROCROAD(COL%,J%)
800 GCOLJ%,COL%
810 II=26+RND(10):INC=RND(2)
820 YR%=YH%(II):IZ=II*20:SI=60+RND(60)
830 DT=RAD(20):TH=RAD(0)
840 S=SIN(DT):C=COS(DT):SS=SIN(TH):CC=COS(TH)
850 II=IZ+SI*SS:MOVE II,YR%:MOVE II+INC,YR%
860 FOR IJ%=YR%-20 TO -20 STEP -20
870 INC=INC+RND(2)
880 SN=SS*C+CC*S:CC=CC*C-SS*S:SS=SN
890 II=IZ+SI*SS:PLOT85,II,IJ%
900 II=II+INC:PLOT85,II,IJ%
910 NEXT IJ%
920 ENDPROC
930 :
940 REM PROCTREE plots a solid ellipsoid tree
950 DEFPROCTREE(XX,YY,J%,COL%)
960 GCOL J%,COL%:VDU29,XL;YL;
970 IF COL%=1 AND RND(10)<=2 THEN GCOL J%,0
980 DT=2*PI/15:A=XX/YY
990 C=COS(DT):S=SIN(DT):SX=S/A:SY=S*A
1000 XA=XX:YA=0
1010 MOVE 0,0:MOVE XA,0
1020 FOR I%=1 TO 15
1030 T=XA*C-YA*SY:YA=YA*C+XA*SX:XA=T
1040 PLOT85,XA,YA:MOVE 0,0
1050 NEXT I%
1060 FOR I%=-XB TO XB STEP 4
1070 MOVE I%,0:DRAW I%,YB
1080 NEXT I%
1090 ENDPROC
1100 :
1110 REM PROCTSHADE and PROCLINE shades the tree
1120 DEFPROCTSHADE(XX,YY)
1130 COL1%=INT(RND(1)+0.5)
1140 IF COL1%=0 THEN COL2%=1 ELSE COL2%=0
1150 CF%(0)=COL1%:CF%(1)=COL2%:VDU29,XL;YL;
1160 PROCLINE(0,YY,0,1)
1170 FOR I=4 TO XX STEP 4
1180 J=YY*SIN(ACS(I/XX))
1190 K%=0:KK%=1
1200 IF POINT(I-1,-J)=CF%(0) THEN K%=1:KK%=0
1210 PROCLINE(I,J,K%,KK%)
1220 PROCLINE(-I,J,K%,KK%)
1230 NEXT I
1240 GCOL0,1
1250 FOR I%=-XB TO XB STEP 4
1260 MOVE I%,-YY:DRAW I%,YB
1270 NEXT I%
1280 ENDPROC
1290 DEFPROCLINE(X,Y,K%,KK%)
1300 GCOL0,CF%(K%):MOVE X,-Y:PLOT21,X,Y
1310 GCOL0,CF%(KK%):MOVE X,-Y+4:PLOT21,X,Y
1320 ENDPROC
1330 :
1340 REM This data holds sets of colour numbers
1350 REM defining autumn,winter,spring and summer
1360 DATA 3,4,2,7,6,4,3,7,6,1,3,7,4,1,3,7,6,4,1,5
1370 DATA 6,4,7,5,6,4,7,0,4,4,7,0,5,4,7,0,4,4,7,0
1380 DATA 5,4,7,0,6,4,7,0,6,5,7,0,6,5,2,0,6,4,2,3
1390 DATA 6,4,2,7,6,4,2,3,6,4,2,7,3,4,2,7,6,4,2,7
```

Figure 2. Random landscape program for 32k BBC micro (series 1 OS) and Electron

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NUDGE, NUDGE

The spinning wheel of fortune, complete with cherries, grapes and tomatoes, awaits as Joe Telford looks at graphics in games

FANCY a flutter? This month I'll show you how to mis-spend your youth (nudge, nudge) on your own fruit machine, but before we can spin the barrels you'll need to know how to create and control user-defined graphics in multicolour. Every gamble, after all, requires a little investment.

Once you can define a shape, overlay it to produce a multicolour character and then control its movements you'll be ready to try your hand on the one-arm bandit.

First, a familiar figure.

Figure 1 shows a simply redefined graphics character which displays a space invader-type alien. Because we are using the eight bits of a byte we can define the foreground of the shape only by using a 1, and the background by using a 0. Thus the statement:

```
VDU23,128,24,60,126,255,255,255,36,0
```

defines a two-tone space invader, with the shape in the current foreground colour and the gaps in the shape in the current background colour. The normal means of putting such a creature onto the screen might be:

```
10 VDU23,128,24,60,126,255,255,255,
   36,0
20 MODE2
30 COLOUR132
40 COLOUR3
50 PRINT TAB(10,10);CHR$128
```

This will produce a yellow invader on a blue background, though the background of the whole screen will be blue only if a line like:

```
35 CLS
```

has been added.

Suppose you wanted a more colourful character, with a blue body and yellow eyes on a black background. The first problem is that only one foreground colour is available with each user-defined graphic character. Two user-defined characters could, of course, do the job, providing they can be printed, one on top of the other. Unfortunately the simple experiment:

```
COLOUR1:PRINT TAB(10,10)"A"
COLOUR2:PRINT TAB(10,10)"B"
```

suggests that our efforts will meet with failure.

Program 1 shows a way of overlaying user-defined graphics. Mode 2 gives access to the full range of colours, but the actual overlaying technique makes use of the VDU5 command.

This command allows text to be printed at the graphics cursor position, ie from 0 to 1279 horizontally and from 0 to 1023 vertically. Because characters printed are regarded as graphics, several can be overlaid to produce the required effect. Figures 1 and 2 show the two characters defined for the UFO of program 1. The overlaying sequence is as follows:

- Set the GCOL for the basic shape.
- MOVE to the graphics position decided on.
- PRINT the first character (1,2,3 done in line 120).
- Set the overlay's GCOL.
- MOVE back to the original position.
- Print the overlay (4,5,6 done in line 130).

Be careful to reconnect the text with the text cursor by issuing a VDU4 command. In short programs such as program 1 this is not necessary, but as program complexity increases, loose ends need tying up, as they invariably lead to bugs.

Having made our first multicoloured UFO, the next avenue for investigation is how to move these overlaid shapes. Program 2 produces just the effect we require. To add colour to our basic UFO, we define four shapes: the UFO; its windows; and the motors (in complementary flashing colours to give the impression of animation within the shape).

Figure 1. Simple two-tone UFO

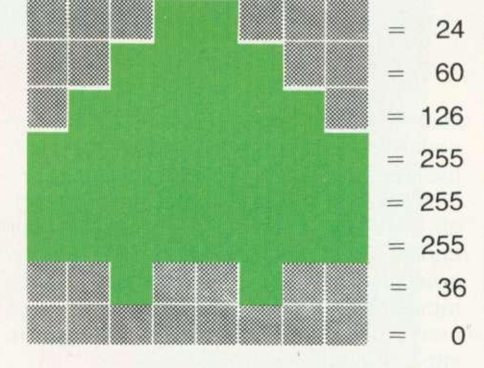
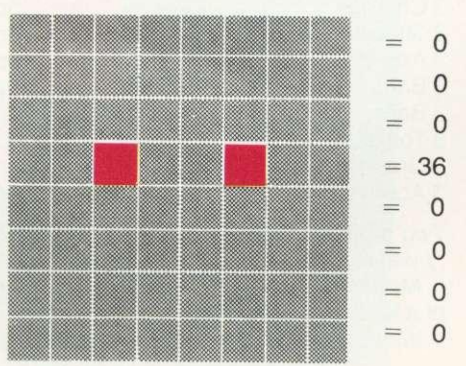


Figure 2. Overlay gives UFO coloured 'eyes'



The shapes are defined and the colours set in lines 20 to 140. Line 160 sets the smoothness (and speed) of movement. At present it is set for 12 units in *x* and *y* axes between display positions for the UFO. Readers might like to vary the setting between 4 and 32 to see the different effects.

The UFO starts almost centrally on the screen, set by line 180. Movement is controlled by the infinite REPEAT loop between lines 200 and 360. This can be broken into these simple steps which are repeated 20 times:

- Print UFO.
- Decide on direction to move.
- Move that way by: deleting UFO; altering the *x* and *y* co-ordinates; and printing the UFO.

The UFO is printed in the procedure at lines 370 to 430. This simply formalises the technique used in program 1. The extra overlays require extra lines of coding, of course, and we pass the printing position as two parameters, 'x' and 'y'. Because the UFO overlays are all within the basic shape (CHR$128), the UFO can be deleted by printing the basic shape with a background colour set as the GCOL. This is done in lines 440 to 480.

Two lines need explanation. Line 310 simply ensures the UFO doesn't vanish off the screen by checking the current *X* and *Y* values. Line 240 sets up the direction of travel as two numbers (X and Y), taking values of −1, 0, or 1. This matches up with eight directions plus a possibility that the UFO will remain stationary. The complete movement of the UFO is random.

The next avenue for investigation was opened during a game of Acornsoft's *Snapper*. Despite the high scores you can obtain (can anyone *not* beat 101,590?), the challenge of eating through the large range of fruit is even more compelling. With this in mind I designed my own fruit based on the *Snapper* variety.

It was immediately apparent that the fruits on show were larger than one defined character. On measuring the screen display it became obvious that the fruit could only be effectively redesigned provided I used four characters for each coloured overlay (*ie* a maximum of four shapes by three colours, or 12 characters).

Figures 3 to 6 show how the overlays were designed for the cherry. Program 3 shows how the characters for the cherry were combined to produce the finished shape on the screen.

First the overlays were coded into defined characters by lines 20 to 80. Next the characters were put into three groups of

four, representing the three coloured overlays: red, green and white. Not all the colours were present in each quarter of the finished fruit, so the space (ASCII 32) character was used to pad the groups of four, as shown in lines 120 and 130. Line 110 contains the colours for each group of four characters: 1 = red, 7 = white, 2 = green.

The next stage is to read these values into two arrays, a one-dimensional numeric array for the colours, and a two-dimensional string array for the three sets of four characters. This is done between lines 140 and 210. We can now print a row of cherries simply by moving to the required positions (line 240) then printing the cherry (lines 270 to 320).

Because the fruits used here are all two characters wide by two characters deep, they can be printed by a FOR NEXT loop such as the one in line 290 to 310, which prints the top two characters in left-to-right order, followed by the bottom two. The STEP 2 of line 290 ensures that only two sets of characters are printed, and line 300 ensures they are characters 1 and 2 or 3 and 4 in any overlay. Line 310 sets the graphics cursor to the next text line down the screen so that the block of four characters is printed in two rows.

Programs 4a and 4b demonstrate an application of multicoloured characters in Super Fruit, a fruit machine simulation. Because the machine works in mode 2 I split the program into three parts to save memory space. Type in part 2 (program 4a) and save it with the filename 'M1'. Type in part 3 and save it with the filename 'M2'. Finally, type in a !BOOT file by *BUILDing it to disc (or type as direct commands on tape systems):

```
NEW
PAGE=PAGE+&100
*FX20,1
CHAIN"M1"
```

Once the programs are typed in and saved, the function key labels of figure 7 may be fitted to the BBC micro. Typing the few direct commands shown above, or performing shift-break if they are on disc in a !BOOT file will cause program 4a to load, and this will in turn load program 4b.

The rules are simple. The function key assignment strip shows all the commands for playing Super Fruit. The message 'SPIN' will appear and you press the spin key. Whenever this key is pressed 1p is deducted from your credit rating. The reels of Super Fruit start spinning, slowing down and stopping after a random time. You may stop any reel before the time limit is up by pressing the appropriate STOP key. Once a reel is stopped it cannot be restarted until the next spin.

When the reels stop, the computer assesses the pattern of fruits and pays out accordingly. After each round the Hold facility is available. To take advantage of the flashing Hold signs press the appropriate Hold key. If you make a mistake in your choice press the matching CLR key to erase your decision. Press the SPIN key to replay. The game stops only when your credit runs out. Random 'Hold after win' is implemented.

Fruits available for payout:

3 Cherries	5p
3 Strawberries	10p
3 Apples	10p
3 Bars	20p
3 Bells	20p
3 Tomatoes	40p
3 Grapes	50p
3 Acorn Users	100p (*Jackpot*)

Two of anything together (*eg* cherry, cherry,bell or bell,cherry,cherry) pays 2p.

Mystery payouts are included as if three of a kind had appeared.

With the small amount of memory avail-

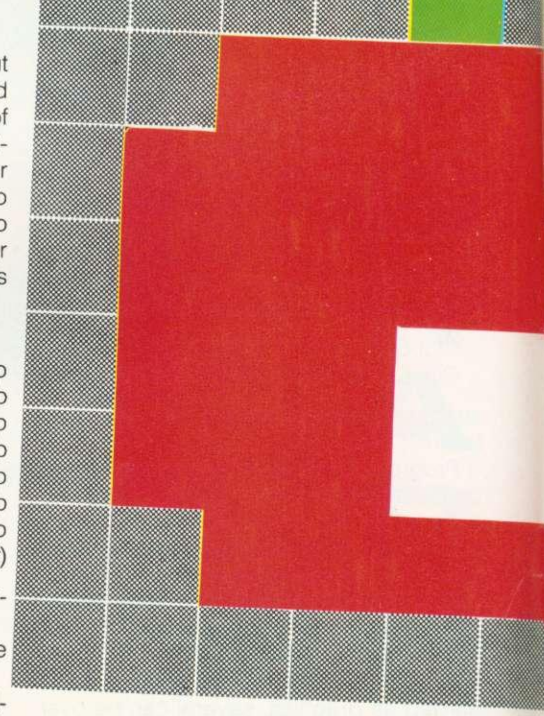


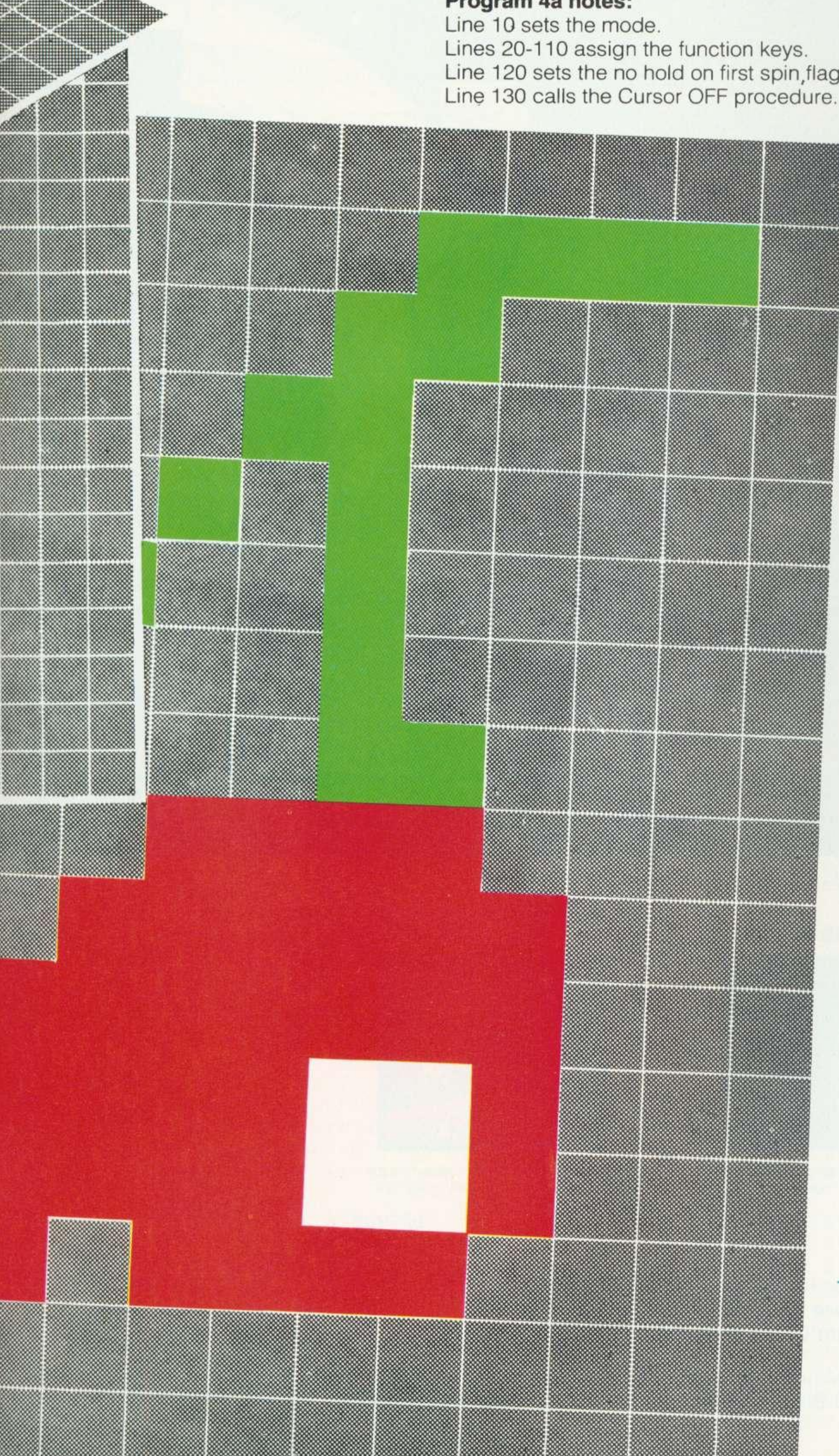
Figure 3.

Main shapes for cherries

Figure 4. Adding the highlights

Figure 5. Another overlay – the stalk

Figure 6. Cherry ripe



able with mode 2, program 4a is the equivalent of one large procedure in a normal program. Its task is to set up all the buffers, for example envelopes and characters, used by the final program. Once these are set up, there is no need to retain the program which set them up, and hence the next program is chained on top of this one.

Program 4a notes:
Line 10 sets the mode.
Lines 20-110 assign the function keys.
Line 120 sets the no hold on first spin flag.
Line 130 calls the Cursor OFF procedure.
Lines 140-770 define fruit and tokens.
Lines 780-820 draw the fruit machine.
Line 830 labels the machine as Super Fruit.
Line 840 sets the field width for printing numbers and initialises the credit to 10p.
Lines 850-880 define four envelopes for: reel movement; jackpot sound; bell on reel stop and credit change; and winning sound.
Lines 890-920 add a border of 1p around the reels.
Line 930 chains the working program.
Lines after 930 are standard library routines which you may recognise from previous articles.
The program uses integer variables A% and C%, which will be retained after the chaining process.

Program 4b handles the running of the fruit machine built by program 4a. The main body of the program is short (10 to 100) and calls three major routines:

SETUP (lines 2000-2999)
This uses data statements to load the fruit into a three-dimensional array, and to load the overlay colours into a matching array (line 2010). The payouts are also set here, as are the flags for HOLD, HELD, STOPPED.

SPIN (lines 5000-5140)
This checks for HOLD (PROCstart) and spins the reels (PROCerase and PROCshow). In addition, this routine handles the early stopping and timing out of the reels. Various delay lines are added to synchronise sound to graphics.

WIN (lines 6000-6030)
This short routine checks the result of the fruits on display and uses a simple algorithm in line 6010 which gives three of a kind payouts and mystery payouts, followed by a two in a line algorithm in line 6020. On a win, PROCpayout is called which increments the credit rating, adds suitable sounds, and checks for a jackpot. On a jackpot, PROCjackpot is called and tokens are displayed as being ejected from the winnings tray.

Altering the parameters:
To change the amount paid out, alter the data of line 2320.
To change the frequency of HOLDs alter the 60 of line 5015.
To remove mystery payouts rewrite line 6010 to:

```
IF R(1)=R(2) AND R(1)=R(3) PROC-
payout(R(1)): ENDPROC
```

To enable a payout for any two fruits the same, rewrite line 6020 to:

```
IF (R(1)=R(2))OR(R(2)=R(3))
OR(R(1)=R(3)) PROCpayout(0)
```

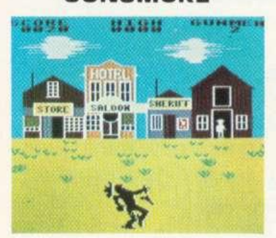
Readers will be aware that the BBC micro's character set can be redefined at will. Normally this redefining is mapped by the OS1.2 software to the 32 characters between &80 and &9F (first mistake in the *Advanced User Guide* page 136). In this state the memory allocation for ASCII codes is said to be 'imploded' and no extra RAM is required to allow for redefining the

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32 characters. Another result of the imploded state of the character set is that the characters from &80 to &9F are mapped to other sets of 32 character allocations, so that defining, for example, character 224 (&E0) is equivalent to defining character &80.

Old-timers such as myself have grown up in the dubious habit of assuming that the first set of 32 redefinable characters starts at ASCII 224. There is little wrong in this idea, provided you use only this first set, or at most explode the character allocations only a little way, say to include the 64 characters from &A0 to &DF. In this article I use the mapped version of the characters starting at 128. In the application program these same shapes are attributed to ASCII codes from 224. Purists should recode them to numbers in the range 128 to 159. ●

```
-----------------------------------------------------------------------------------------------------------
S F!      !       !      !        !       !       !       !       !       !
U R!      !       !      !        !       !       !       !       !       !
P U! STOP ! STOP  ! STOP !  HOLD  ! HOLD  ! HOLD  ! CLR1  ! CLR2  ! CLR3  !  SPIN
E I!  :1  !  :2   !  :3  !   :1   !  :2   !  :3   !       !       !       !
R T!      !       !      !        !       !       !       !       !       !
-----------------------------------------------------------------------------------------------------------
```

Figure 7. Overlay for fruit machine

Program 1. UFO with two foreground colours

```
   10 REM DEFINE BASIC UFO
   20 VDU 23,128,24,60,126,255,255,255,
36,0
   30 REM DEFINE UFO WINDOWS
   40 VDU 23,129,0,0,0,36,0,0,0,0
   50 REM SELECT MODE
   60 MODE2
   70 REM SELECT UFO COLOUR
   80 ufocol=4
   90 windowcol=10
  100 REM now print UFO on screen
  110 VDU5
  120 GCOL0,ufocol:MOVE512,640:VDU128
  130 GCOL0,windowcol:MOVE512,640
:VDU129
  140 VDU4
  150 END
```

Program 2. Four-colour moving UFO

```
   10 ON ERROR MODE7:END
   20 REM DEFINE BASIC UFO
   30 VDU23 ,128,24,60,126,255,255,255
,102,0
   40 REM DEFINE UFO WINDOWS
   50 VDU23,129,0,0,36,0,0,0,0,0
   60 REM DEFINE ENGINES
   70 VDU23,130,0,0,0,0,0,170,0,0
   80 VDU23,131,0,0,0,0,0,85,0,0
   90 REM SELECT MODE
  100 MODE2
  110 REM SELECT UFO COLOUR
  120 ufocol=4
  130 windowcol=3
  140 enginecol=9:engine2col=14
  150 REM set scale of step size
  160 scale=12
  170 REM now choose start points
  180 sx=640:sy=512
  190 REM and enter loop round to move
ufo
  200 REPEAT
  210 REM print ufo
  220 PROCoverlay_ufo(sx,sy)
  230 REM decide on next position
  240 dx=(RND(3)-2)*scale:dy=(RND(3)-2)
*scale
  250 REM move 20 times that way
  260 FOR I%=1 TO 20
  270   REM erase old ufo position
  280   PROCdelete_ufo(sx,sy)
  290   REM update locations
  300   sx=dx+sx:sy=dy+sy
  310   IFsx>1216 ORsx<0 ORsy<32 OR
sy>1024 sx=sx-dx:sy=sy-dy
  320   REM overlay at new position
  330   PROCoverlay_ufo(sx,sy)
  340   REM delay loop
  350 NEXT
  360 UNTIL FALSE
  370 DEFPROCoverlay_ufo(x,y)
  380 VDU5
  390 GCOL0,ufocol:MOVEx,y:VDU128
  400 GCOL0,windowcol:MOVEx,y:VDU129
  410 GCOL0,enginecol:MOVEx,y:VDU130
  420 GCOL0,engine2col:MOVEx,y:VDU131
  430 VDU4:ENDPROC
  440 DEFPROCdelete_ufo(x,y)
  450 VDU5
  460 GCOL0,0:MOVEx,y:*FX19
  470 VDU128
  480 VDU4:ENDPROC
```

Program 3. Large cherries

```
   10 MODE2
   20 REM define chars for cherry
   30 VDU23 ,128,8,61,127,127,127,126,
60,0
   40 VDU23 ,129,240,248,248,248,248,
240,0,0
   50 VDU23 ,130,0,0,0,0,12,12,0,0
   60 VDU23,131,0,0,0,48,48,0,0,0
   70 VDU23,132,0,0,0,0,0,1,2,4
   80
VDU23,133,0,30,48,96,160,160,32,48
   90 REM then put them into
  100 REM coloured overlays
  110 DATA1,7,2
  120 DATA32,32,128,129,32,32,130
  130 DATA131,132,133,32,32
  140 DIMfruit$(3,4),colour(3)
  150 FORcol= 1 TO 3
  160   READcolour(col)
  170 NEXTcol
  180 FORoverlay= 1 TO 3
  190   FORchar= 1 TO 4
  200     READ A:fruit$(overlay,char)=
CHR$A
  210   NEXTchar,overlay
  220   REM print a row of cherries
  230 VDU5
  240 FOR X=0 TO1100 STEP200
  250   REM print each cherry in
  260   REM 3 overlaid colours,
  270   FORoverlay= 1 TO 3 :Y=500
  280     GCOL0,colour(overlay)
  290     FORchar= 1 TO 4 STEP2
  300       MOVEX,Y:PRINTfruit$(overlay,
char);fruit$(overlay,char+1)
  310       Y=Y-32:NEXT
  320     NEXToverlay,X:VDU4
```

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Program 4a. Super Fruit initialisation

```
   10 MODE2
   20 *KEY0 1
   30 *KEY1 2
   40 *KEY2 3
   50 *KEY3 A
   60 *KEY4 B
   70 *KEY5 C
   80 *KEY6 D
   90 *KEY7 E
  100 *KEY8 F
  110 *KEY9 S
  120 A%=0
  130 PROCcrsr(0)
  140 VDU23 ,224,0,61,127,127,127,126
,60,0
  150 VDU23 ,225,240,248,248,248,248,
240,0,0
  160 VDU23,226,0,0,0,0,12,12,0,0
  170 VDU23,227,0,0,0,48,48,0,0,0
  180 VDU23,228,0,0,0,0,0,1,2,4
  190 VDU23 ,229,0,30,48,96,160,160,
32,48
  200 VDU23,230,12,0,0,0,0,0,0,0
  210 VDU23,231,56,14,3,1,0,0,0,0
  220 VDU23,232,28,112,192,0,0,0,0,0
  230 VDU23,233,0,0,0,6,63,127,127,127
  240 VDU23 ,234,0,0,0,224,252,254
,254,254
  250 VDU23,235,63,63,31,31,15,7,3,1
  260 VDU23 ,236,252,252,248,248,240,
224,192,128
  270 VDU23,237,0,0,0,0,4,0,36,65
  280 VDU23,238,0,0,0,0,64,16,4,0
  290 VDU23,239,4,0,0,10,0,0,1,0
  300 VDU23,240,0,144,0,32,0,64,0,0
  310 VDU23,241,0,0,0,0,0,31,63,127
  320 VDU23,242,24,62,254,2,0,0,0,144
  330 VDU23 ,243,127,127,127,127,63,
63,31,15
  340 VDU23 ,244,0,72,128,80,128,64,
0,128
  350 VDU23,245,0,0,3,3,3,3,1,4
  360 VDU23,246,0,0,0,0,0,120,252,110
  370 VDU23,247,0,33,4,2,0,1,0,2
  380 VDU23 ,248,254,182,126,174,124,
188,248,112
  390 VDU23,160,0,0,0,0,0,0,255,255
  400 VDU23,161,0,0,0,0,0,113,74,74
  410 VDU23,162,0,0,0,0,0,156,82,82
  420 VDU23,163,115,74,74,114,0,0,0,0
  430 VDU23,164,220,84,82,82,0,0,0,0
  440 VDU23,165,255,255,255,0,0,0,0,0
  450 VDU23,166,3,7,7,15,15,15,15,31
  460 VDU23 ,167,128,192,192,224,224,
224,224,240
  470 VDU23,168,31,31,63,254,0,0,0,0
  480 VDU23,169,240,240,248,62,0,0,0,0
  490 VDU23,170,0,0,0,1,3,3,1,0,0
  500 VDU23,171,0,0,0,192,192,64,128,0
  510 VDU23,172,0,0,0,15,0,0,0,31
  520 VDU23,173,0,0,0,224,0,0,0,240
  530 VDU23,174,0,0,0,8,30,63,63,63
  540 VDU23 ,175,0,0,0,16,120,252
 252,252
  550 VDU23,176,63,63,63,31,15,15,7,3
  560 VDU23
 177,252,252,252,248,240,240 ,224,192
  570 VDU23,178,0,30,1,0,0,0,0,0
  580 VDU23,179,0,0,128,64,224,64,0,0
  590 VDU23,180,0,0,0,0,0,8,8,8
  600 VDU23,181,8,4,4,4,2,2,0,0
  610 VDU23,182,0,0,0,3,15,31,31,63
  620 VDU23 ,183,0,0,0,248,252,252,
252,248
  630 VDU23 ,184,63,127,127,127,255,
254,120,0
  640 VDU23 ,185,248,240,240,224,128,
0,0,0
  650 VDU23,186,7,0,0,0,0,0,0,0
  660 VDU23,187,195,228,24,0,0,0,0,0
  670 VDU23,188,0,0,0,0,2,0,10,0
  680 VDU23,189,0,0,0,16,64,40,64,16
  690 VDU23,190,34,8,33,68,17,64,16,0
  700 VDU23,191,64,0,32,0,0,0,0,0
  710 VDU23,249,1,3,3,7,7,7,7,0
  720 VDU23 ,250,192,224,224,240,240,
240,240,0
  730 VDU23,251,15,15,15,7,99,56,7,0
  740 VDU23 ,252,248,248,248,240,224
,128,224,64
  750 VDU23,253,1,2,4,8,16,32,64,128
  760 VDU23 ,254,60,126,211,213,211,
215,86,60
  770 VDU23 ,255,255,255,255,255,255
,255,255,255
  780 GCOL0,7
  790 PROCrect(0,0,1280,1024,1)
  800 GCOL0,0:FOR X=1 TO 3 :
PROCrect(192+(320*(X-1)),544,256,128,1)
:NEXT
  810 PROCrect(192,64,892,96,1)
  820 GCOL0,1:
PROCrect(192,896,896,96,1)
  830 COLOUR129:COLOUR3:PRINTTAB(4,2);
"SUPER  FRUIT"
  840 @%=8:C%=10:COLOUR131:COLOUR1:
PRINTTAB(3,26)"CREDIT"C%
  850 ENVELOPE1
 4,1,-2,1,1,1,1,127,0,0, 0,126,126
  860 ENVELOPE2,5,20,-40,20,1,1,1,127,
0,0,-127,126,126
  870 ENVELOPE3
,1,0,0,0,0,0,0,127,-4,0, -1,126,100
  880 ENVELOPE4 ,1,1,2,4,10,10,10,127,
0,0,-127,126,126
  890 COLOUR128:COLOUR3
  900 PRINTTAB(1,9);STRING$(18,CHR$254)
  910 PRINTTAB(1,16);
STRING$(18,CHR$254)
  920 FORX=10 TO 15:
PRINTTAB(1,X);CHR$254;TAB(18,X);CHR$254
:NEXT
  930 CHAIN"M2"
  940 DEFPROCrect(x,y,l,w,f)
  950 MOVEx,y:DRAWx+l,y
  960 IFf=0 DRAWx+l,y+w ELSE
PLOT85,x,y+w
  970 IFf=0 DRAWx,y+w ELSE
PLOT85,x+l,y+w
  980 MOVEx,y+w:IFf=0 DRAWx,y ELSE
MOVEx,y
  990 ENDPROC
 1000 DEFPROCcrsr(x):IFx=0
VDU23;8202;0;0;0;:ELSE
VDU23;29194;0;0;0;
 1010ENDPROC
```

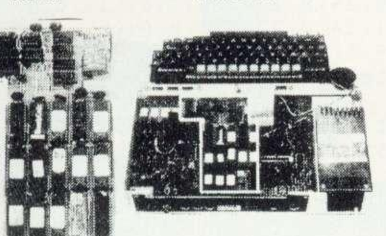
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Reference	Description (Accessories)	ExcVAT	IncVAT
BKADVANC	Advanced User Guide for the BB Micro	13.25	13.25
BKALPBBC	Assembly Language Prog for the BBC (593)	8.50	8.50
CNBPOWER	Plug for BBC Power Outlet (1-480424-0)	0.95	1.09
CNDISCPO	Power socket for Disc Drive (1-350234-9)	0.95	1.09
ACBCASEH	Hard carrying case for BBC	45.44	52.25
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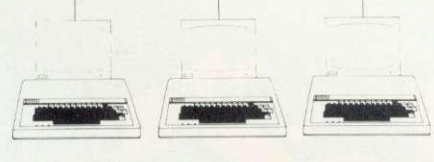
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BRCCTERM	Computer Concepts Termi rom (Terminal)	26.60	30.59
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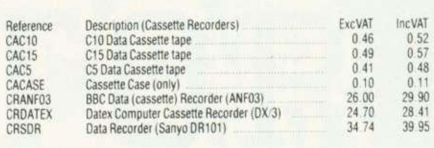
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AA1e+12	Acorn Atom Micro 12K ram 12Krom	82.56	94.95
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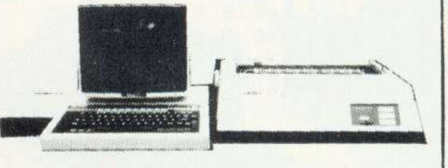
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CRDATEX	Datex Computer Cassette Recorder (DX/3)	24.70	28.41
CRSDR	Data Recorder (Sanyo DR101)	34.74	39.95

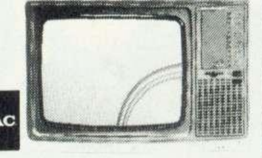




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DDT200SE	Teae 200K Single 80T Disc Drive for BBC	222.30	255.65
DDT400DE	Teac 400K Dual 80T Disc Drive for BBC	439.85	505.83
DDT400SF	Teac 400K Single 80T Disc Drive for BBC	288.80	332.12
DDT800DF	Teac 800K Dual 80T Disc Drive for BBC	572.85	658.78
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MNK12G	Kaga K12G 12" Green Monitor	94.05	108.16
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PPFF1K	1000 Sheets fan-fold tractor feed paper	6.19	7.12
PPROLLTR	Roll paper for Sparkjet/Epson (TR-1)	1.70	1.96
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PRE80	Ribbon for Epson MX/FX/RX 80	5.70	6.55
PRJP101	Inkjets for JP101 (pack of 4)	5.70	6.55
PRMX100R	Ribbon refill for Epson MX/FX 100	4.37	5.03
PRTP1200	Fabric Ribbon for Smiths Corona TP-1	2.85	3.28
PRTP1220	Film Ribbon for Smiths Corona TP-1	2.85	3.28
PTCP80	CP-80 80cps Printer (MX-80 type III)	284.05	326.66
PTFX80	Epson FX80 160cps Printer	365.09	419.85
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PTJ6100	Junki 6100 Daisy Wheel Printer 18cps	365.09	41985
PTJP101	BBC Spark-Jet Printer	284.05	326.66
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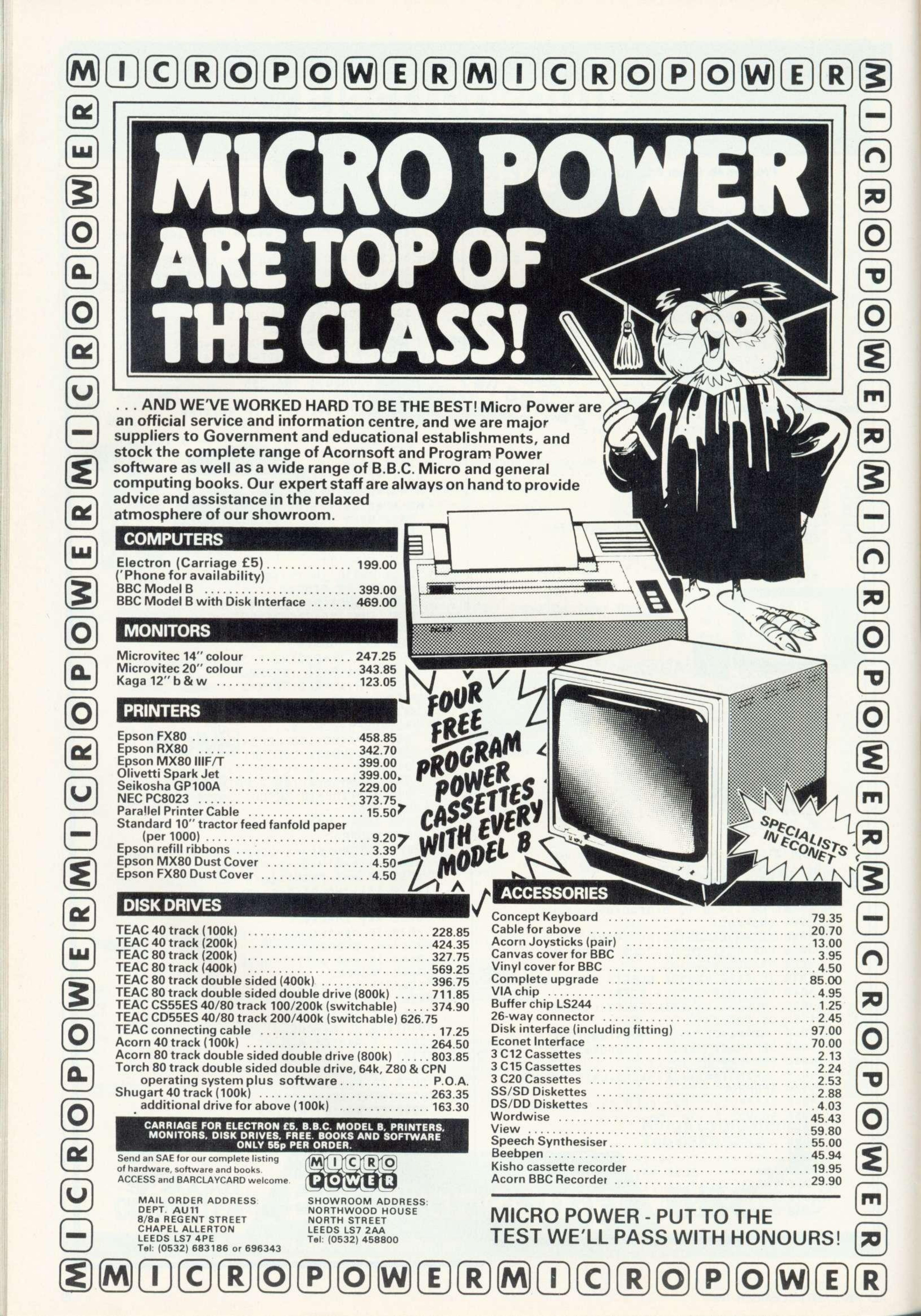


BBC

36-38 West Street, Fareham, Hants (0329) 230670

Program 4b. Super Fruit main routines

```
   10 REM J.Telford 1983
   20 REM SUPERFRUIT PART 2
   30 PROCsetup
   40 REPEAT
   50 PROCspin
   60 PROCwin
   70 UNTIL C%=0
  100 END
 2000 DEFPROCsetup:RESTORE
 2010 READnf:DIM F$(nf,3,4),c%(nf,3)
 2020 FORfruit= 1 TO nf
 2030   FORovrlay= 1 TO 3:READ
c%(fruit,ovrlay):NEXT
 2040   FORovrlay= 1 TO 3
 2050     FORchar=1 TO 4:READ A
 2060     F$(fruit,ovrlay,char)=CHR$(A)
 2070     NEXTchar,ovrlay,fruit
 2100 DATA8
 2110 DATA1,7,2
 2120 DATA32,32,224,225,32,32,226,227,
228,229,230,32
 2130 DATA2,1,7
 2140
DATA231,232,32,32,233,234,235,236,
237,238,239,240
 2150 DATA0,2,1
 2160 DATA32,32,32,32,241,242,243,244,
245,246,247,248
 2170 DATA0,5,3
 2180 DATA32,32,32,32,160,160,165,165,
161,162,163,164
 2190 DATA3,1,4
 2200
DATA166,167,168,169,32,32,170,171,
172,173,32,32
 2210 DATA1,2,7
 2220
DATA174,175,176,177,178,179,32,32,
180,32,181,32
 2230 DATA5,2,6
 2240
DATA182,183,184,185,186,187,32,32,
188,189,190,191
 2250 DATA10,9,14
 2260 DATA249,250,251,252,97,32,32,117,
32,253,253,32
 2300
DIMR(3),H(3):R(1)=0:R(2)=0:R(3)=0:
H(1)=0:H(2)=0:H(3)=0
 2310 DIMpay(8):
 2320 DATA2,5,10,10,20,20,40,50,100
 2330 FOR I%= 0 TO 8:READpay(I%):NEXT
 2999 ENDPROC
 3000 DEFPROCshow(F%,P%):VDU5
 3010 FOR O%=1 TO 3:GCOL0,c%(F%,O%)
 3020 x%=256:y%=640
 3030 IF P%=2 x%=576 ELSEIF P%=3 x%=896
 3040 FOR CH%= 1 TO 4 STEP2
 3050 MOVEx%,y%:PRINTF$(F%,O%,CH%);
F$(F%,O%,CH%+1)
 3060   y%=y%-32:NEXT,:VDU4:ENDPROC
 4000 DEFPROCerase(P%):COLOUR128
 4010 FOR L%= 11 TO 13
 4020   PRINTTAB(4+(P%-1)*5,L%)"    ":NEXT
 4030 ENDPROC
 4040 DEFPROCjackpot:COLOUR3:COLOUR128
 4050 SOUND2,2,100,255
 4060 VDU28,3,29,16,27
 4070 FOR X= 1 TO 25
 4080   FOR Y= 1 TO 14:IF RND(3)<3
PRINTCHR$(254); ELSE PRINT" ";
 4082   NEXT:VDU13,11,11
 4090 T=TIME+5:REPEAT UNTIL TIME>T:NEXT
 4100 VDU11,11,11,11
 4105 SOUND&12,0,100,0
 4110 VDU26:ENDPROC
 5000 DEFPROCspin
 5010 COLOUR135:COLOUR8:PRINTTAB(8,22);
"SPIN"
 5015 IF RND(100)>60 H=1 ELSE H=0
 5016 IF H=0 H(1)=0:H(2)=0:H(3)=0:
PROCtidy
 5017 IF A%=0 H=0:A%=1
 5020 PROCstart:COLOUR135
 5030 PRINTTAB(8,22);"    "
 5035 COLOUR131:COLOUR1:C%=C%-1:
SOUND3,3,74,5:PRINTTAB(9,26)C%
 5040 T=TIME+1000+RND(500)
 5045 SOUND0,1,100,255
 5050 REPEAT
 5060 FOR I%=1 TO 3:IF H(I%)=0
R(I%)=RND(nf)
 5070 PROCerase(I%):PROCshow(R(I%),I%)
 5074 COLOUR129:COLOUR3
 5075 stop=VAL(CHR$(INKEY(0))): FOR
H%=1 TO 3:IFstop=H%
H(H%)=2:PRINTTAB(3+(
H%-1)*5,18);"STOP":SOUND3,3,148,5
 5076 NEXT
 5080 NEXT
 5082 IF T-TIME<600:TT=TIME+20:REPEAT
UNTIL TIME>TT
 5120 UNTIL (H(1)<>0 AND H(2)<>0 AND
H(3)<>0) OR TIME>T
 5130 SOUND&10,0,100,0
 5135 TM=TIME+200:REPEAT UNTIL TIME>TM
 5140 ENDPROC
 6000 DEFPROCwin
 6010 IFR(1)+R(2)=2*R(3) THEN
PROCpayout(R(1)):ENDPROC
 6020 IFR(1)=R(2) ORR(2)=R(3)
PROCpayout(0)
 6030 ENDPROC
 7000 DEFPROCpayout(c):SOUND1,4,100,15
 7002 TM=TIME+100:REPEAT UNTIL TIME>TM
 7005 COLOUR131:COLOUR1
 7010 FOR Q%= 1 TO pay(c):C%=C%+1
 7020   SOUND3,3,148,2:PRINTTAB(9,26)C%
 7030 TM=TIME+10:REPEAT UNTIL TIME>TM
 7040 NEXT
 7050 IFc=8 PROCjackpot
 7060 ENDPROC
 8000 DEFPROCstart:COLOUR129:COLOUR10
 8002 H(1)=0:H(2)=0:H(3)=0
 8005 IF H=1 PRINTTAB(3,18);"HOLD";
TAB(8,18);"HOLD";TAB(13,18);"HOLD"
 8010 REPEAT
 8020 A$= INKEY$(0)
 8030 IF A$="S" UNTIL TRUE:
PROCtidy:ENDPROC
 8040 IF H=0 UNTIL FALSE
 8042 COLOUR3
 8045 IF A$="A" H(1)=1:
PRINTTAB(3,18);"HELD"
 8050 IF A$="B" H(2)=1:
PRINTTAB(8,18);"HELD"
 8060 IF A$="C" H(3)=1:
PRINTTAB(13,18);"HELD"
 8065 COLOUR10
 8070 IF A$="D" H(1)=0:
PRINTTAB(3,18);"HOLD"
 8080 IF A$="E" H(2)=0:
PRINTTAB(8,18);"HOLD"
 8090 IF A$="F" H(3)=0:
PRINTTAB(13,18);"HOLD"
 8100 UNTIL FALSE
 9000 DEFPROCtidy
 9010 COLOUR135:FOR M%=1 TO 3
 9020 IF H(M%)=0 PRINTTAB
(3+(M%-1)*5,18);"    "
 9030 NEXT:ENDPROC
```


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GRAPHS

Stan Froco explains how pictures are used to represent computing problems

A COMMON way of representing problems within a computer is to create a pictorial representation of them by using graphs. A graph consists of a number of points or 'vertices' joined by lines.

Figure 1 is a graph of part of Cambridge which represents the routes between various colleges of the University. We can improve the map by adding the distances between the colleges (figure 2). Anyone who has spent time in Cambridge will realise this graph is only of use to pedestrians. It is known as an 'undirected graph' and assumes it is the same distance from A to B as it is from B to A.

If we redraw the graph for motorists we must mark the routes with arrows, representing the one-way system. For instance, to drive from Pembroke to Emmanuel is only about 300 yards, but to drive from Emmanuel to Pembroke you have to go round the one-way system, a distance of about 1500 yards. Figure 3 is an example of a directed graph.

The problem is one of finding the distance between places on a directed graph. The simplest problem to solve is to calculate the shortest routes between a place and all other places on the map. Program 1

Program 1. To find the shortest routes in Cambridge

```
 10 ******************************************************************
 20
 30 REM   A program to demonstrate Dijkstra's algorithm
 40
 50 ******************************************************************
 60
 70 now% = TIME
 80
 90 DIM college$(7)
100
110 FOR i% = 2 TO 7
120    READ college$(i%)   :REM The textual names
130    NEXT i%
140
150
160 PROCdijkstra(7, 280)
170
180 PRINT "Shortest route from Emmanuel:"
190 FOR i% = 2 TO 7
200    PRINT "   to " ; college$(i%) ; " is " ; d%(i%)
210    NEXT i%
220 PRINT ' "Time taken " ; TIME - now% ; "cs."
230
240 END
250
260 DATA Pembroke, Kings, Caius, Trinity, John's, Sidney
270
280 DATA 1, 2, 1500
290 DATA 1, 7, 400
300 DATA 2, 1, 300
310 DATA 2, 3, 300
320 DATA 3, 2, 300
330 DATA 4, 7, 200
340 DATA 5, 4, 100
350 DATA 6, 5, 100
```

continued on page 43

calculates the length of the shortest route between Emmanuel and all the other colleges, using a method devised by E W Dijkstra.

It might be thought that a more useful problem to solve would be that of finding the shortest route between just two points, but it turns out that to solve that problem you need to know the shortest routes between other places anyway. The best way to find the shortest route between, say, Emmanuel and Pembroke would be to find the shortest route between Emmanuel and all the other colleges and then take the result for Pembroke.

The PROCdijkstra program deals with a graph with nvert% vertices. The way we represent the graph is to number the vertices on the graph, so the vertex from which we wish to know all the distances (Emmanuel in figure 4) is vertex 1.

The graph can then be represented by an 'adjacency' matrix. This is a two-dimensional array (c% in PROCdijkstra). The direct distance (*ie*, not via any other vertices) from vertex a to vertex b is in element c%(a, b) of this array. Thus c%(1, 2) is 1500, the distance from vertex 1 (Emmanuel) to vertex 2 (Pembroke).

If two points are not connected directly, we set them to a very large value. Here I have chosen 1,000,000 since this is much larger than any value that will otherwise occur. For convenience, this is held in a variable, infinity%. The values for this matrix are read in from data in lines 620 to 670. The line number where this data starts is data%.

We maintain a table of shortest known distances from vertex 1 by any route in d%. Initially this will be set from c%, so it will have only lengths that are direct paths. Thus d%(i%) initially has the value in c%(1, i%). We know that one of these shortest known distances is exactly right, that for d%(1). The distance from vertex 1 to vertex 1 must always be zero.

from page 41

```
360 DATA 7, 5, 100
370 DATA 7, 6, 200
380 DATA 0, 0, 0
390
400 *******************************************************************
410
420 REM   Arguments are the number of vertices, and the start of the data
430 REM   The results are returned in the array d%
440
450 *******************************************************************
460
470 DEF PROCdijkstra(nvert%, data%)
480
490 LOCAL infinity%, i%, j%, s%, c%
500
510 DIM s%(nvert%)              :REM The special route vertices
520 DIM c%(nvert%, nvert%)      :REM The adjacency matrix
530 DIM d%(nvert%)              :REM The results
540 infinity% = 1000000
550
560 FOR i% = 1 TO nvert%   :REM Clear the adjacency matrix
570    FOR j% = 1 TO nvert%
580       IF i% = j% THEN c%(i%, j%) = 0 ELSE c%(i%, j%) = infinity%
590       NEXT j%
600    NEXT i%
610
620 RESTORE data%
630
640 REPEAT
650    READ i%, j%
660    READ c%(i%, j%)
670    UNTIL i% = 0
```

continued on page 44

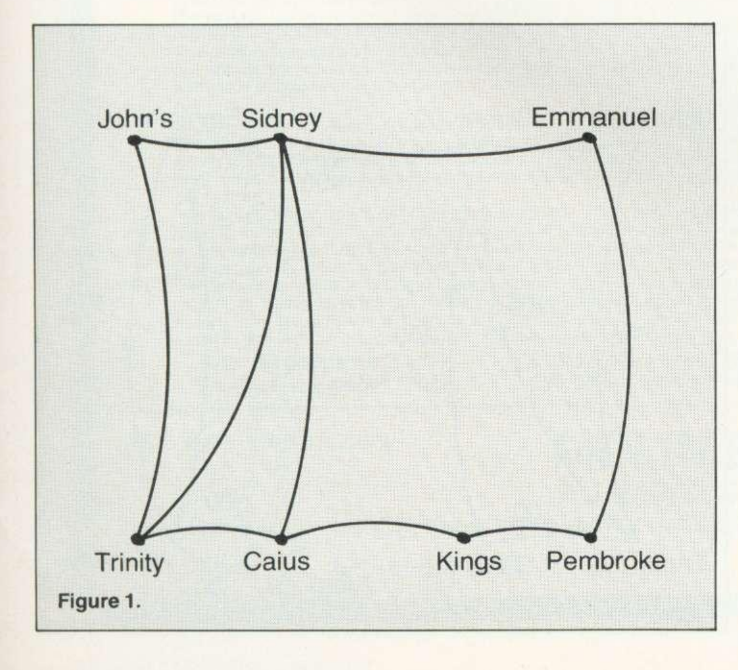


Figure 1.

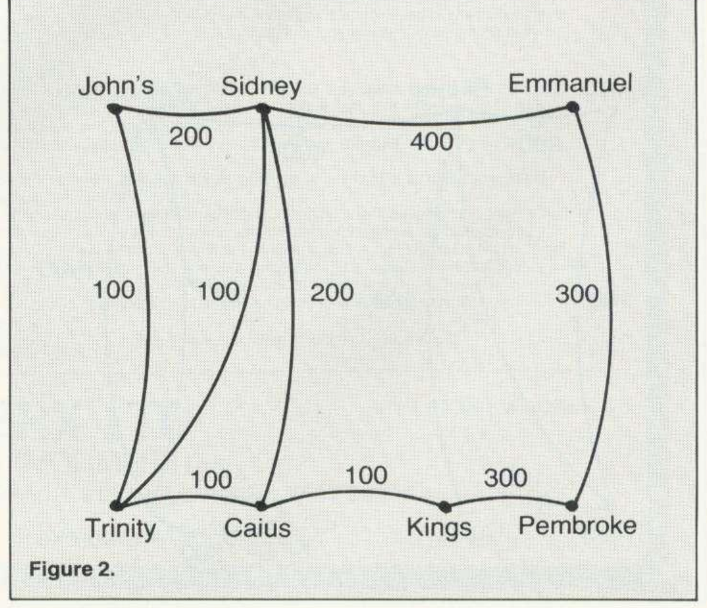


Figure 2.

Finally we set up an array s%. This is a table of 'special' vertices – those for which we know the shortest known distance is exactly right. We set s%(a) to TRUE if a is a special vertex. This set is increased by one each time round the loop from lines 770 to 870, until all elements are TRUE. When this happens we know all the shortest known values in d% are exactly correct.

On starting up we set s%(1) to TRUE, since we know d%(1) is exact. We than select the 'non-special' vertex with the lowest value in d% (lines 780 to 810 – note how d%(0), which is always infinity%, is used to start things off) and declare it a 'special' vertex (line 820). We then see whether this new 'special' vertex can be used to update the shortest known paths in d% for the remaining 'non-special' vertices. This is done in lines 840 to 860. For each 'non-special' vertex we see if going to the vertex via d% (nearest%) is shorter, and if so use this as the shortest known distance.

Having done this for each vertex, we return with the results in d%.

It is not easy to convice yourself that when you add each new 'special' vertex it is the shortest possible path. Could there be a shorter path going via some 'non-special' vertex x, *ie* so that d%(x) + c%(x, nearest%) is less than d%(nearest%).

This cannot be so, since it would require d%(x%) to be less than d%(nearest%) – c% cannot have negative values but we already know that nearest% is the closest 'non-special' vertex. Nor can there be a shorter path via any 'special' vertex, since each time round we use line 850 to check this is not the case for each 'special' vertex as it is created.

If you do not see this straightaway don't worry, you don't need it to use the technique. Sit down and draw some graphs and you will convince yourself the method always works.

```
680
690 FOR i% = 1 TO nvert%
700    d%(i%) = c%(1, i%)
710    s%(i%) = FALSE
720    NEXT i%
730
740 d%(0) = infinity%
750 s%(1) = TRUE
760
770 FOR i% = 2 TO nvert%   :REM Do once for each remaining vertex
780    nearest% = 0   :REM d%(0) is always infinity%
790    FOR j% = 2 TO nvert%
800       IF NOT s%(j%) THEN IF d%(j%) < d%(nearest%) THEN nearest% = j%
810       NEXT j%
820    s%(nearest%) = TRUE
830
840    FOR j% = 2 TO nvert%   :REM Can we shorten any other routes
850       IF NOT s%(j%) THEN
             d%(j%) = FNmin (d%(j%), d%(nearest%) + c%(nearest%, j%))
860       NEXT j%
870 NEXT i%
880 ENDPROC
890
900 ******************************************************************
910
920 REM    FNmin returns the smaller of its two arguments
930
940 ******************************************************************
950
960 DEF FNmin(a%, b%)
970    IF a% < b% THEN =a% ELSE =b%
```

If we just wanted to know, say, the distance between vertex 1 and vertex 3, we could speed things up by stopping as soon as vertex 3 became special, since we need to know only that d%(3) is exact.

This month I have solved only half the problem. Having found the length of the shortest route it would be useful to know what that route was.

Next month we'll go through a solution to this problem when I look at further applications of graphs. ●

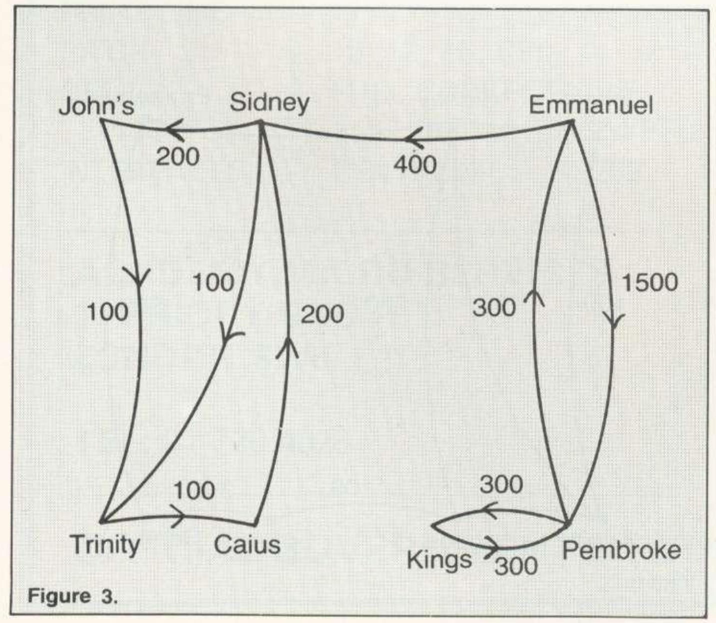


Figure 3.

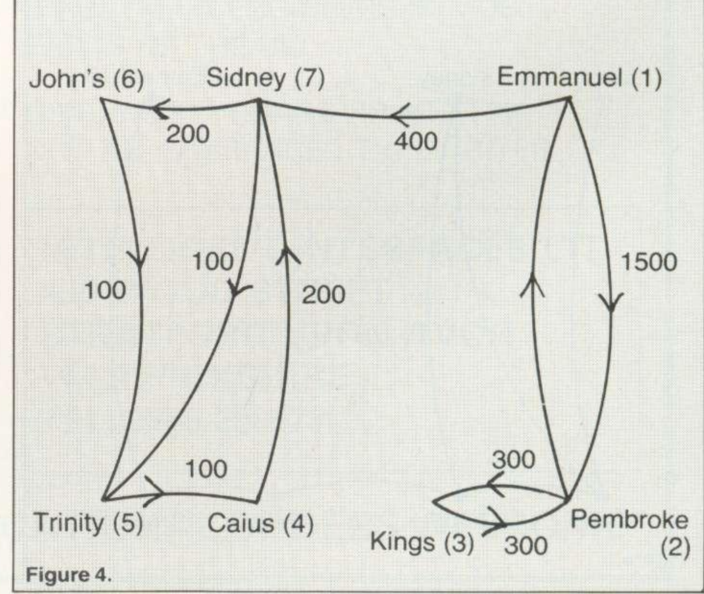
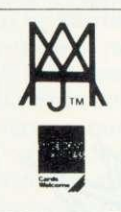


Figure 4.

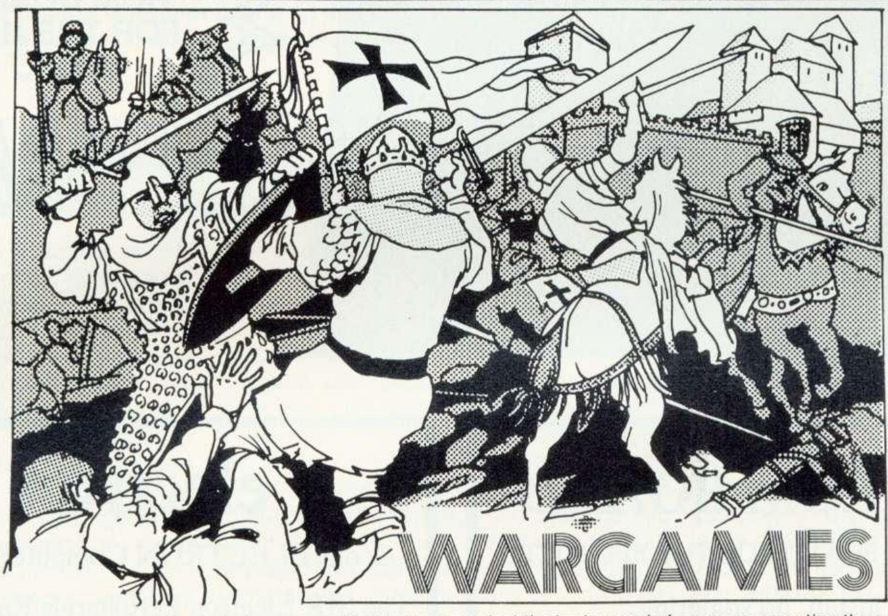


Software News



INNOVATIVE
BBC SOFTWARE

from the professionals



All computer wargames are played in a similar manner, that is to say against the background of a map representing the geography of the time and place in question. On the BBC machines these maps are particularly attractive. The author has taken full advantage of the available resolution and colour.

Also most wargames are played in a similar manner. Troops or whatever are moved from one area to another, taxes are levied and desertions result from a bad commander. In addition, of course, it is necessary to fight battles and win wars — that is what it is all about! Molimerx have the following three wargames available for the BBC machine.

EMPEROR

The time of this wargame is the first four centuries AD. The player takes the part of the Emperor and he must pit his wits and forces against invading barbarians, rebellious provincials and treacherous Roman Generals. Even the Plebs of Rome will have to be placated with bread and circuses if the Emperor is to keep his head and his throne. If he can last out for the first eight years of the game he is judged on the state of the Empire at the end of that time. There are three levels of play. Depending upon his choice, the Emperor has to guide the Empire through the first, third and fourth centuries. To win in the first century he must expand the Empire by two provinces, in the third he must maintain his Empire intact and in the fourth he must lose not more than two Provinces. For each Province the player is given three items of information, the number of loyal Legions, the number of revolting Legions and the number of Barbarian Invaders of Local Rebels. During play Legions must be raised, taxes inflicted and troops moved. The choice of Generals can be very critical — some are loyal and good fighters, some are neither. Battles must be fought and invasions repelled. All the while the citizens in Rome must be kept happy and — you must keep an eye on those Barbarians in Britannia!

CRUSADERS

The scenario of Crusaders is that you are the King of Jerusalem and have to rule your Kingdom from 1169 to 1177. Your ultimate aim is to prevent any incursions by the invading Saracens. You have a total of forty-eight fortresses, all interconnected by caravan routes. The program will pick these off one by one, unless you can defeat the Saracen army in the field, by gathering together an army for yourself from the various garrisons. Each year consists of six (bi-monthly) moves. At the end of each year (at play rating 6), you will find a new Saracen army moves into the Kingdom from enemy territory. All Saracen armies that stay in the field for a year are reduced by desertions.

The program itself has an artificial intelligence, in as much as the Saracens attempt to seige and take castles and fortresses that they have not previously moved to. In this way, a Saracen army that has been seigeing for a few years may be reinforced by a new army, which may be sufficient troops to effect the taking of the fortresses.

NAPOLEON

Napoleon is an excellent wargame in which the player tries to change history by doing better than the great Napoleon Bonaparte himself. The object of the game is to conquer Europe completely. Battle commences in June of 1798, and the player has until the end of 1815 in which to manoeuvre the initial six armies in such a way as to defeat the forces of Britain, Austria, Prussia, Russia, Spain and Portugal. It must have been comparatively nice to do war in those days because the armies only move in the summer months. In the winter they are resting.

The computer controls all of the opposing forces. The player must concentrate on keeping his armies up to strength, finding the enemy, moving his armies to the correct situations and finally, of course, engaging the enemy in battle.

At the beginning of each year the program will raise taxes for you, but on the other side of the ledger, money will be deducted from your Treasury every month to pay your troops. Desertions were rife in the 18th and 19th century wars, so the player must be certain to feed his troops completely or they might defect. Indeed, although the player starts with six armies, any or all of them can be lost by desertions or, of course, by being defeated by the enemy. Once disseminated, an army cannot be re-formed. Similar rules apply to enemy armies which you destroy. As Napoleon is written by an Englishman it is natural that Britain should have one small advantage, which is that the British armies can start in Portugal, Spain or Prussia, or all three. Otherwise, all of the armies of the European countries start off on their own soil.

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SOFTWARE CATALOGUE ——— A4 size stamped addressed envelope for 17p.

THIS problem page is a new, regular feature of *Acorn User* presented by Martin Phillips. It will present simple hints and tips and answer readers' queries about the Electron, BBC micro and BBC Basic. £5 will be paid for a 'star' letter, so you can profit from your problem!

If you have a query concerning some aspect of programming or some technical difficulty, please give sufficient information and make your question specific. The following query was received recently:

'I am in the middle of writing a program for an exam project on my 32k BBC. However, although the program is only just over 21k long, when it is run the computer prints up the error message 'No room' or 'Dim space'. I would be grateful if you could tell me any methods of running the program successfully without the need to cut the program up.'

Now, there are any number of reasons why a program will run out of memory. Without knowing far more about the program, the style of programming and techniques used, and whether discs Econet have been fitted, it is impossible to give anything but general hints on memory saving. It also helps to know the operating system and Basic.

So please bear these points in mind and include a listing if possible. Unfortunately, we cannot reply to letters individually, and are unable to return letters, listings, etc. Send you letters to: Hints & Tips, Acorn User, 53 Bedford Square, London WC1B 3DZ.

NUMBERS ON BEEB AND ELECTRON

HOW do the BBC and Electron micros handle numbers? Well, they differentiate between two types of numbers, real, which can contain a fractional part, and integers, which are whole numbers. Integer variables are distinguished by having a per cent sign as the last character of the variable name, eg number% and count%. They can only store numbers between −2,147,483,648 and 2,147,483,647. Integer variables are stored with complete accuracy and are operated on more speedily by the computer.

There are also 27 integer variables which the *User Guide* calls 'resident integer variables'. They are A% to Z% and @%, and have a permanently allocated space in memory. As a result, their values are not lost when RUN or NEW are entered, or even when the break key is pressed. This enables values to be carried by these variables from one program to another. (Have you ever wondered how the *Welcome* tape remembers whether your cassette has motor control from one program to another? It uses the resident integer variable M% to inform each individual program.) @% has a special function, as we shall see.

Real numbers with a value between 2×10^{38} and 2×10^{-39} can be stored by the computer and can include negative numbers. The disadvantage with real numbers is that they can only be stored to nine-figure accuracy. The numbers must be converted to binary before being stored which leads to problems, as some numbers cannot be represented with complete accuracy this way. This is a similar problem to the recurring decimal found when 10 is divided by 3 or when trying to exactly calculate the value for the ratio of diameter to circumference of a circle. This ratio called pi is a never-ending decimal, and can never be represented with total accuracy.

To illustrate the difficulty of storing and retrieving numbers accurately look at programs 1 to 3. The first works as one would expect; but with only a slight change in numbers, program 2 does not give the correct result. It is interesting to print out the values for A, B and C and see what happens to them. Program 3 will do this. To add to the confusion, we find that it prints out the correct values even though the program has given the wrong result!

Before you throw your BBC or electron away and rush out to buy another computer, I should point out that this program will not work correctly on most other micros either! The reason is that the computer has a routine built into the PRINT statement to check for, and correct errors in number storage and retrieval. Unfortunately, for some of our readers there are no such routines in the equals, greater than or less than operators and these have given rise to problems (example overleaf).

```
10 REM Program 1
20 A=3.2
30 B=6.4
40 C=9.6
50 IF A+B=C PRINT"Correct"
60 PRINT"I've finished"

10 REM Program 2
20 A=3
30 B=6.4
40 C=9.4
50 IF A+B=C PRINT"Correct"
60 PRINT"I've finished"

10 REM Program 3
20 A=3
30 B=6.4
40 C=9.4
50 IF A+B=C PRINT"Correct"
60 PRINT "A = ";A
70 PRINT "B = ";B
80 PRINT "C = ";C
```

Programs 1-3. Number confusion

MYSTERY OF THE COMPUTER'S LONG GAPS

ANOTHER puzzle for many readers is why the computer prints out numbers with long gaps before them. Program 4 illustrates the difficulty. The times table is printed out with wide spacings across the screen. Users of Atoms are familiar with the @% variable, but with the BBC it often never emerges from the depths of the *User Guide*. Understanding the function of the @% variable is not helped by a poorly explained definition in the reference section of the *User Guide*. In its simplest, and most useful form, @% can be set to give the number of spaces that will be reserved on the screen for a number. The number is printed at the right hand end of the spaces. It is normally set to 10 so a two-figure number will have eight leading spaces, or blanks, before it. The largest number required in the tables program will be 100 (10 times 10), so @% can be set to be three characters wide. This is called the field width. Add line 20 to program 8.

20 @%=3

Now the program should be displayed in a more acceptable format. The field width can take any value between 0 and 255.

However, as we have come to anticipate with many aspects of the BBC, this @% variable has a more complex form. In hexadecimal notation the number is made up of four parameters.

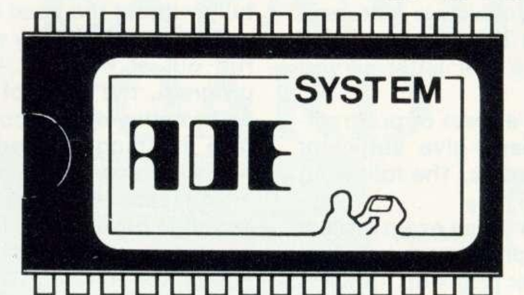
@%=& (B4) (B3) (B2) (B1)

B1 is the character field width. B2 is the number of digits printed in any of the formats available. It must have a value from 0 to 9. If the actual number is larger than specified by B2, it will be rounded off.

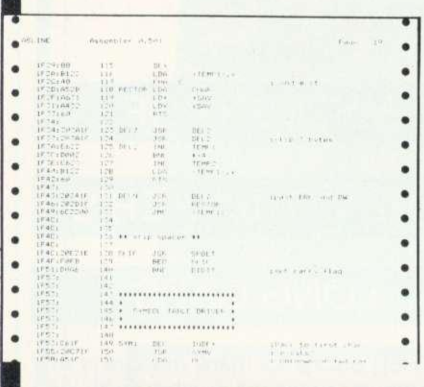
B3 selects the type of format for printing out the number. There are three types of format. The first, B3=0, is called the general format and is the one normally used. Integers will be printed as integers. Num-

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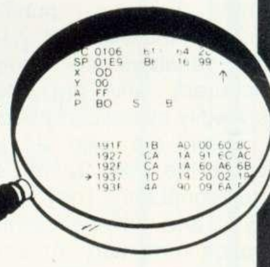


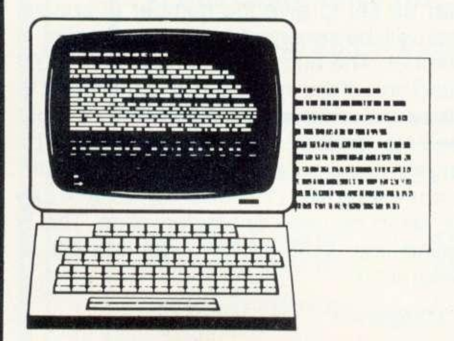
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bers in the range 0.1 to 1 will be printed as 0.1 etc. Numbers less than 0.1 will be printed in exponent format. Next, setting B3 to 1 will put the print format into scientific notation where all numbers are printed as exponents, eg 1000 will become 1E3 and 1200 will become 1.2E3. Finally B3=2 is the fixed format where numbers will be printed with a fixed number of decimal places.

B4 determines whether a number converted by the STR$ function will be formatted by the above rules. If B4=1, strings will be formatted paying attention to the setting of @%. Its normal value is 0. If B1=10 (0A in hexadecimal), B2=3, B3=2 and B4=1, @% would take the value of

@%=&0102030A

If you find all this too much to grasp at once, use @% in its simplest form to control the character field width until you become more familiar with the idea. Do remember, however, that @% is one of the resident integer variables and will keep its value from one program to the next if the computer is left on and no 'hard' break is performed. This can give the most odd results! Set @%= 10 to return things to normal.

```
10 REM Program 4
30 INPUT"Which table?
   "table
40 FOR N=1 TO 10
50 PRINT N" x"table"
   ="N*table
60 NEXT N
```

Program 4. Illustrates long gaps

HOW TO CHECK IF TWO FIGURES AGREE

£5

MR SARGENT writing from Sussex wins £5 for his letter with a looping problem: 'I have written a program to analyse pay etc, but in accumulating and checking totals against batch figures I am continually held in a loop when testing to check if the figures agree. This seems to occur when a negative entry is made in the transactions.

'I have printed out both variables to check they are equal and my check also prints "diff = 0.00". Is there a feature of the BBC machine that affects the "<>" and "=" operators when negative entries are made?'

Mr Sargent is quite correct in his assumption, and it can affect any real numbers, whether positive or negative, as we have already seen. There are two possible cures. The first is to multiply the real numbers by 100 and work in integer arithmetic. To display the results divide them by 100. (For the sake of simplicity we are assuming that halfpence will be ignored.)

Program 5 illustrates this method. Using the print format variable, the figures are printed out to two decimal places. By using integer arithmetic it is possible to store values up to £2m accurate to the nearest penny.

This method as it stands is not foolproof, as real numbers still have to be stored in memory. (Try adding £29.49 and £10.) To get around this, instead of multiplying and dividing by 100, change the program to multiply and divide by 1000. This means the real number is converted with a ten-fold greater accuracy. (It now also enables halfpence to be entered.)

The other cure is to use a relative test rather than trying to equate two totals exactly. As any value less than £0.005 has no significance in our monetary system, we can use this to provide a better test for totals agreeing. Program 6 shows how this can be done. The ABS statement ensures the test will work if either total is larger.

```
 10 REM Program 5
 20 @%=&20200
 30 amount%=0
 40 PRINT"Press 0 to end"
 50 REPEAT
 60 INPUT"Amount in pounds and pence £"amount
 70 amount%=amount%+amount*100
 80 UNTIL amount=0
 90 INPUT"Enter total £"total
100 total%=total*100
110 IF amount%=total% PRINT"Figures agree"
120 PRINT"£"amount%/100"      £"total%/100
```

Program 5. Working in integer arithmetic

```
 10 REM program 6
 20 @%=0
 30 tot=0
 40 PRINT"Press 0 to end"
 50 REPEAT
 60 INPUT"Amount in pounds and pence £"amount
 70 tot=tot+amount
 80 UNTIL amount=0
 90 INPUT"Enter total £"total
100 IF ABS(tot-total)<0.001 PRINT"Figures agree"
110 PRINT"£"tot"      £"total
```

Program 6. Relative testing

CONFUSION OVER VARIABLE 'E'

PAUL Holgate from Nottingham has discovered that the variable 'E' can be confused by the computer and regarded as scientific notation, because the computer will read numbers in this format, eg PRINT 2E3 will give 2000. Problems can arise in two areas. The first is where the computer will take the first letter of a variable as scientific notation. Program 7 gives just such an example. It can be cured by leaving a space before the End% or by changing the variable to end%. The second occurs with the use of the VAL statement. Try program 8, it will give an answer of 5000000, but should only 'see' the first figure and print out 5. This can give odd results at the most unexpected times and is a possibility that needs to be checked for.

```
10 REM Program 7
20 number%=5:End%=0
30 IF number%=5End%=1
40 PRINT End%


10 REM Program 8
20 A$="5E6F7G"
30 PRINT VAL(A$)
```

Program 7, 8. Scientific notation problem



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WHEN IS THE RIGHT ANSWER WRONG?

A PROBLEM similar to Mr Sargent's came from Mr K Wong in Hong Kong: 'I have written a short program (program 9) which is a division exercise working to one decimal place. It seems that when the answer is correct the computer says that it is wrong! When the computer then prints out the correct answer, it is the same as the one which it said was wrong.'

There are two reasons why this program will not run correctly. First, an answer, correct to one decimal place, is entered but there is no rounding off to one decimal place of the actual result of the division before testing for agreement takes place. The answer is tested against a result accurate to nine decimal places and the two will rarely agree. For example if we divide 10 by three, the computer will store the result as 3.333333333 but the answer expected will be 3.3. The result must first be rounded off to one decimal place.

However, even if this point is cured, the method for checking the answer will fall into the trap discussed above.

The difficulties can be overcome best by using integers for the arithmetic calculations and converting them to real numbers for display purposes. Mr Wong's program has been rewritten to show this technique (program 10). It has also been structured differently to give more meaningful questions.

```
10 REM Program 9
20 @%=&20100
30 X=RND(100)
40 Y=RND(30)
50 PRINT X" divided by "Y"=?"
60 INPUT ANS
70 IF ANS=X/Y THEN PRINT"Correct"
   ELSE PRINT "Wrong. The
   correct answer is "X/Y
```

Program 9. Division won't work properly

```
10 REM Program 10
20 @%=0
30 number%=RND(100)
40 result%=RND(10)
50 PRINT (number%/10*result%)
   " divided by "number%/10" = "
60 INPUT answer
70 IF answer=result% PRINT "correct"
   ELSE PRINT "Wrong. The correct
   answer is "result%
80 GOTO 40
```

Program 10. Converts from integer to real numbers

THE ALL-MODE DUMP

George Hill's graphics dumps will work on all the Epson 'bit image' printers and the Star 510

IN THE September issue I introduced the process of devising a simple black and white, or on/off dump for the Seikosha AP100A and Epson MX80 printers, using a hybrid program – one which contains both Basic and assembly language.

The technique is developed in the three listings presented here for the Epson printers. They are designed to perform a pattern dump of the colour graphics screen in various shades or patterns. However, assembly language dumps can present the unwary with 'off-the-screen' readings which will ruin the colour effects they are trying to achieve (*see box below*).

All three programs will work on any of the Epson range of 'bit image' printers, including the MX80 and 100 series from type 2 up, and the FX80. Correspondence with readers and other research has revealed that the Star 510, and future offerings from Star, the Gemini and Delta, actually use the same control codes as Epson. This is so unusual in the printer world that one wonders whether collusion is involved – anyway, this attempt at standardisation is welcome. The only difference of any importance is in the use of ESC 3, which is not used in my programs. This means that any of the Epson dumps printed so far will work for the Star 510. Program 1, for instance, was used by one of our readers to produce one of the 'fancy bowls' in September's issue, on a Star 510 in six minutes.

Program 2 is a teaching program which enables me to explain the processes used in writing this pattern dump without the encumbrance of dealing with multiple modes. It has undergone minor surgery to become program 3, my present pride and joy, which will dump all graphics modes (0,1,2,4 and 5) in about five minutes. It produces as many tones as there are colours in the mode in use.

Programs 2 and 3 use subroutines from the September issue. That article explained in detail how to obtain the value of the colour of a pixel (subroutine 'point'), and how to send a character to the printer only (subroutine 'printchar'). These are used in the assembly language section of the pattern programs. In addition, the subroutines to increment and decrement the values of various parameters are also needed.

First, the storage of the assembly language section in both programs. Space is reserved at address S% by the command DIM S% for the required number of bytes. S% is subsequently incremented to reserve bytes for the various parameters used in the assembled code.

The pattern in program 2 is stored in four bytes by a pling (!). The relationship of these bytes to the pattern is illustrated in figure 2.

Three printer bytes are prepared at a time, each pixel being represented by a 3 × 2 matrix. The variable 'pass' keeps track of which byte is being prepared. The required byte of pattern is selected first on the basis of colour, by the lines:

890ldy value
and then

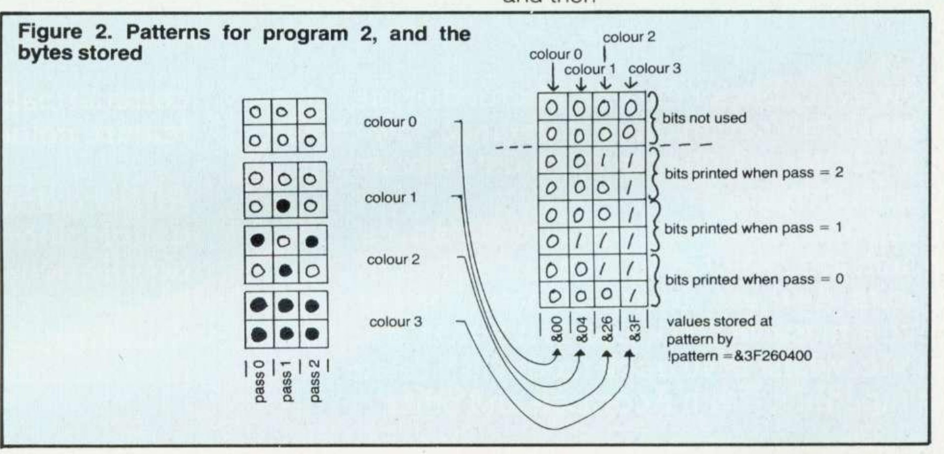
1023

dump will cover this area

graphics origin set by VDU29;640;512;

Figure 1.

Figure 2. Patterns for program 2, and the bytes stored



TWO POINTS TO REMEMBER

THERE ARE two important points which the graphics dump user should be aware of.

- If a point is 'off the graphics screen' (ie outside the limits 0 to 1279 and 0 to 1023 or outside the limits imposed by a VDU24 graphics window definition) the computer returns the value −1 for the 'colour' at the point. For example the result of X=POINT(0,1024) is normally −1 (or is 255 if obtained via Osword).

  This means assembly language dumps may cause black dots to be printed for these points rather than blanks. Take care!

- The use of VDU29 to re-define the graphics origin often results in the dump attempting to read 'off-the-screen points'. For example, if VDU29,640;512; has been used to move the origin to the centre of the screen, then a dump using limits 0 to 1279 for X and 1023 to 0 for Y (as most of mine do) will read only the top right-hand quarter of the screen (figure 1).

  The solution is to insert the command VDU29,0;0; to re-set the graphics origin at any time before the dumping process actually starts. Program 1 includes this command at line 1030.

I have decided to abandon the inclusion of the *FX5 command to call the printer in my dumps. The inclusion of a parallel printer call causes the program to 'hang up' if a serial printer is connected, and vice-versa. The parallel printer is in fact called by default – no action is normally needed.

For a serial printer use *FX5,2, then *FX8,n where n is chosen to match the computer-to-printer baud rate. Use *FX156,16,227 if two stop bits are needed (particularly for Epson at 9600 baud).

The commands VDU2 and VDU3 are still included to enable and disable the printer.

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750. two_bits lda pattern,Y

This uses indexed addressing, and selects the byte whose address is (pattern +contents of Y register).

Thus if 'value' is 2, the byte selected is that given by the Basic function

?(pattern+2) or
pattern?2

We now need to select which two bits are to be rotated into the printer byte. These are the two least significant bits on the first pass (pass=0), the next two with pass=1, and so on. The method is to use the commands 'rol' and 'ror' in combination to transfer bits from one location to another (the role of the carry bit in the rotate commands was explained in the September article). The idea is to pick the first two bits if pass=0 (rotate in), otherwise move all the bits to the right twice (ignoring the lost bits), decrement pass, and repeat until pass becomes 0 (figure 3).

To rotate the bits into byte, the command ror A rotates the least significant bit of the accumulator (containing the pattern) into the carry bit, and rol byte rotates the carry bit into the least significant bit of byte. This is repeated to complete the transfer of two bits.

The Y parameter (Ylo and Yhi are the low and high bytes of Y%) is decremented by four by subroutine 'dec Y4' for each two-bit pattern. It is then taken back to its original value by routine 'inc Y16' at the completion of each byte.

The Basic program sets the value of pass (?pass=0) before entry to the assembled code. 'Pass' is incremented after each byte, and when the required number of bytes is complete (three for the mode 1 version), control is returned to the Basic section by the final rts command.

This assembly language requires little modification to enable it to cope with any mode. The pixel size in the various modes makes it necessary to print three bytes per pixel for modes 1 and 4. Mode 5 has pixels twice as big, but mode 1 dump will read each pixel twice, and pick correct patterns for the four colours available. Mode 2 requires the printing of a six-dot wide pattern, and this requires the modification of the final comparison in the assembly language. We must cmp #6 instead of cmp #3.

The mode 0 pixels are half as narrow as those of mode 1 and would require the printing of a 1.5 dot band. As this is not possible, I fear a touch of distortion has been introduced in the mode 0 dump and a one-dot wide band is printed. The final comparison becomes cmp #1.

These changes in the constant required for comparison are coped with simply by comparing with a variable 'pass number', which is poked with the correct number (1,3,or 6) before entry to the code.

The next problem is to change the patterns. Modes 0 and 1 require only two patterns, as a pixel is either on or off, so we print either no dots or all dots. Modes 1 and

```
1000 DEFPROCEPSDUMP
1010 REM * Copyright G.B.Hill June 1982*
1020 REM Single tone picture dump for use with BBC MICRO and EPSON MX-80 FT2 pr
inter
1030 VDU29,0;0; :REM zero graphics cursor
1040 VDU2,1,10,1,10,1,10 :REM clear print buffer if necessary
1050 VDU1,27,1,65,1,8 :REM Linefeed setting ,ESC,A,8
1060 FOR Y%=1023 TO 0 STEP -32
1070 VDU1,27,1,75,1,64,1,1 :REM ESC,K,n1,n2, 320 characters per line
1080 FOR X%=0 TO 1279 STEP 4
1090 byte=0
1100 FOR y%=0 TO 31 STEP 4
1110 byte=byte*2
1120 IF POINT(X%,Y%-y%)>0 THEN byte=byte+1
1130 NEXT
1140 VDU1,byte
1150 NEXT
1160 VDU1,10 :REM Linefeed
1170 NEXT
1180 VDU1,27,1,50 :REM Normal linefeed
1190 VDU 1,27,1,70 :REM Cancel condensed characters
1200 VDU1,12,1,7,3 :REM formfeed and beep, disable printer
1210 ENDPROC
```

Program 1. On/off dump for Epsons and Stars

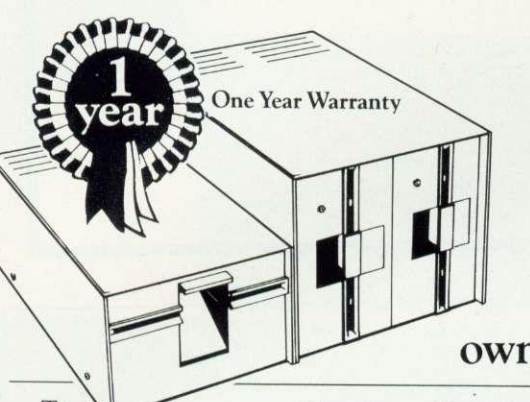
Program 2. Writing pattern dumps

```
 10 REM *** EPAT1 ***
 20 REM Hybrid program to dump the MODE1 graphics screen
 30 REM on the EPSON MX80 FT printer
 40 REM G.B.Hill September 1983  (c)
 50 REM PROGRAM START
 60 DIM S% 140
 70 pattern=S%
 80 !pattern=&3F260400
 90 S%=S%+4
100 PROCassemble
110 REM enable printer, and set linefeed (send ESC A 8)
120 VDU2,1,27,1,65,1,8
130 REM clear paper
140 VDU1,10,1,10,1,10
150 FOR Y%=1023 TO 0 STEP -16
160 REM send bit code (ESC L 192 3 - 960 dots per line)
170 VDU1,27,1,76,1,192,1,3
180 FOR X%=0 TO 1279 STEP 4
190 !Xlo=X%+Y%*&10000
200 ?pass=0
210 CALL pixel
220 NEXT
230 VDU1,10
240 NEXT
250 REM reset linefeed, send formfeed and disable printer
260 VDU1,27,1,65,1,12,1,12,3
270 END
280 DEFPROCassemble
290 osword=&FFF1
300 oswrch=&FFEE
310 Xlo=S%
320 Xhi=S%+1
330 Ylo=S%+2
340 Yhi=S%+3
350 value=S%+4
360 byte=S%+5
370 pass=S%+6
380 count_4=S%+7
390 S%=S%+8
400 FOR opt=0 TO 2 STEP 2
410 P%=S%
420 [OPT opt
430 \SUBROUTINES
440 \to calculate POINT(X,Y)
450 .point          ldx #Xlo MOD 256
460                 ldy #Xlo DIV 256
470                 lda #9
480                 jsr osword
490                 rts
500 \subroutine to print a character
510 .printchar      lda #1
520                 jsr oswrch
530                 lda byte
540                 jsr oswrch
550                 rts
560 \decrement Y by 4
570 .dec_Y4         sec
580                 lda Ylo
```

continued on page 57

Microware presents the latest news on BBC.

N.B. 40/80 Format Switch – call for information



ZL DISK DRIVES

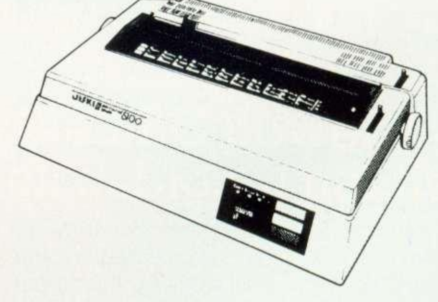
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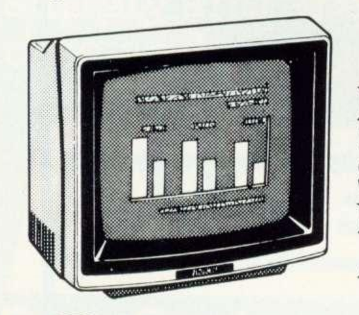
Type		Capacity in MFM	Capacity BBC in FM	No. of files on BBC	Price	Members discount %
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ZL141	Single plus PSU	250K	100K	31	225.00	5
ZL142	Single plus PSU	500K	200K	62	315.00	5
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5 require four patterns for the four colours, and mode 2 requires eight patterns for its eight colours. The patterns are stored sequentially at the beginning of the program in the normal way and are accessed by indirect addressing.

This has been dealt with in other articles but a brief explanation is necessary. We store the address of any pattern in the 'zero page' at addresses &80 and &81. This is done in the Basic program by the instructions

?&80=pattern MOD 256
?&81=pattern DIV 256

which transfer the low and high bytes of the address to &80 and &81 respectively.

The pattern can now be accessed by altering the instruction

lda pattern,Y
to
lda (&80),Y

This is illustrated in figure 4.

There is a little trick in the method for mode 2, which requires six passes. The byte being rotated would be corrupted after four passes, so the program rotates the first four bits of the pattern in place of the missing bits 8, 9, 10 and 11. This means ensuring that while pass goes from 0 to 6, the index X counts from 0, 1, 2, 3, 0, 1. This is done using the lines

lda pass	the pass number is put into the accumulator
and #3	eliminate all but the two least significant bits
tax	and transfer the result to the X register

If you want to use this type of operator (AND is a 'logical operator') in Basic the three-line program snippet printed below

program 2
continued from page 55

```
 590                    sbc #4
 600                    sta Ylo
 610                    bcc dec_Yhi
 620                    rts
 630 .dec_Yhi           dec Yhi
 640                    rts
 650 \increment Y by 16
 660 .inc_Y16           clc
 670                    lda Ylo
 680                    adc #16
 690                    sta Ylo
 700                    bcs inc_Yhi
 710                    rts
 720 .inc_Yhi           inc Yhi
 730                    rts
 740 \to rotate in two bits. Enter with X=pass, Y=colour.
 750 .two_bits          lda pattern,Y        \select appropriate byte of pattern
 760                    cpx #0               \if pass is 0 rotate
 770                    beq rotate_in        \next two bits in
 780 .rotate_out        ror A                \otherwise dump two bits
 790                    ror A
 800                    dex                  \has X reached 0?
 810                    bne rotate_out       \if not dump two more
 820 .rotate_in         ror A                \if so next two bits go into byte
 830                    rol byte
 840                    ror A
 850                    rol byte
 860                    rts
 870 \to calculate a whole byte
 880 .one_byte          jsr point
 890                    ldy value
 900                    lda pass
 910                    and #3
 920                    tax
 930                    jsr two_bits
 940                    jsr dec_Y4
 950                    dec count_4
 960                    bne one_byte         \if byte incomplete go back
 970                    jsr printchar        \print the byte
 980                    rts
 990 \MAIN PROGRAM
1000 \to calculate and print the pattern for one pixel
1010 .pixel             lda #4
1020                    sta count_4          \reset counter
1030                    jsr one_byte
1040                    jsr inc_Y16
1050                    inc pass
1060                    lda pass
1070                    cmp #3
1080                    bne pixel
1090                    rts
1100 ]
1110 NEXT
1120 ENDPROC
```

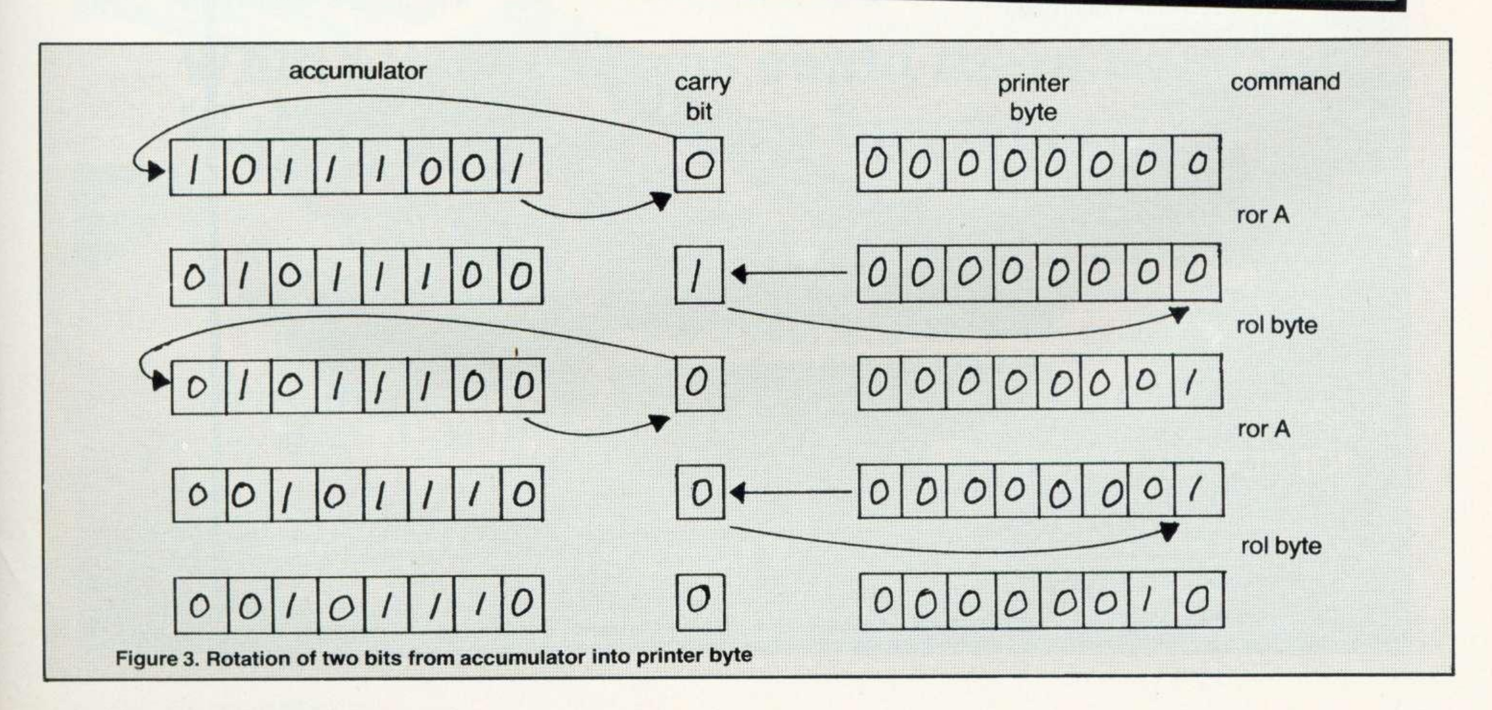


Figure 3. Rotation of two bits from accumulator into printer byte

Addresses (two bytes: high low)			Contents (one byte)
pattern + 3	21	A8	3F
pattern + 2	21	A7	26
pattern + 1	21	A6	04
pattern	21	A5	00
zero page addresses	&81		&21
	&80		&A5

"pointing" here

Figure 4. Indirect addressing

illustrates the effect:

10 FOR I=0 TO 50
20 PRINTI, I and 3
30 NEXT

The step size for the controlling X% loop will also have to change, being two for mode 0, four for modes 1, 4 and 5, and six for mode 2. This is managed by setting the variable step size to the required number, and using

FOR X%=0 TO 1279 STEP step_size

Mode 0 prints only 640 dots per line instead of 960, so the parameters n1 and n2 in the ESCape 'L' sequence are reset according to the normal Epson rules, ie, n1=number of dots MOD 256, n2=number of dots DIV 256.

There remains the problem of determining which mode we are in, and setting up these variables. This is accomplished in PROClimits.

This routine first reserves four bytes for the result of a USR call.

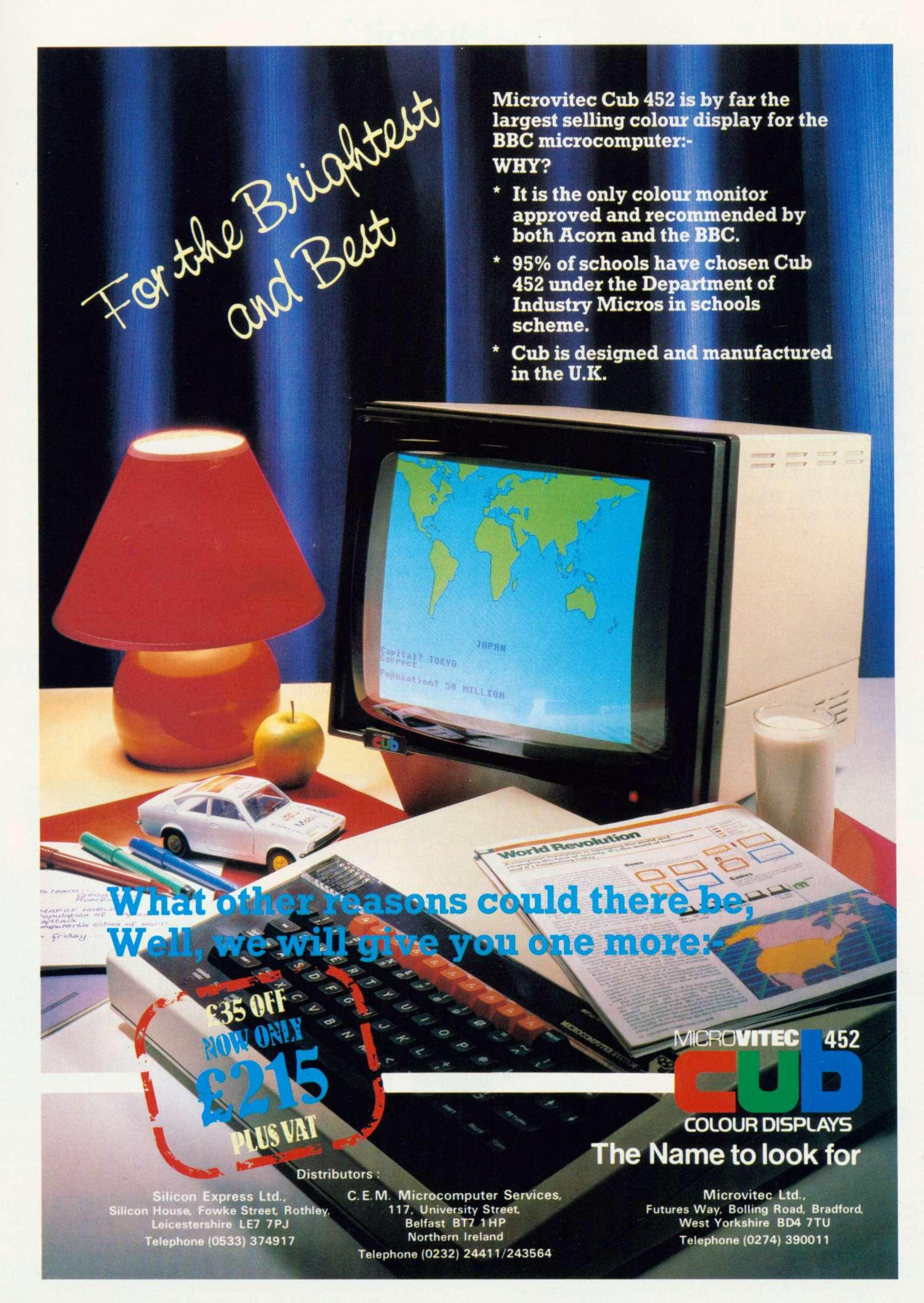
DIM user 3
jsr printchar (*lines 1210 and 1220*)

This has the effect of reversing the byte (ie, it will now contain 0 in place of 1, and 1 in place of 0), and so will produce a 'positive' instead of 'negative' screen dump. ●

Program 3. Dumps all graphics modes

```
   10 REM *** EPATALL ***
   20 REM Hybrid program to dump all graphics MODEs
   30 REM on the EPSON MX80 FT printer
   40 REM G.B.Hill September 1983 (c)
   50 REM PROGRAM START
   60 DIM S% &FF
   70 pass_number=S%
   80 pattern0=S%+1
   90 !pattern0=&0300
  100 pattern4=S%+3
  110 !pattern4=&3F00
  120 pattern1=S%+5
  130 !pattern1=&3F260400
  140 pattern2=S%+9
  150 !pattern2=&49841000
  160 !(pattern2+4)=&FF6FB966
  170 S%=S%+17
  190 PROClimits
  200 IF NOT graphics THEN PRINT"Not a graphics MODE. Can't dump.":VDU7:END
  210 PROCassemble
  220 REM enable printer, and set linefeed (send ESC A 8)
  230 VDU2,1,27,1,65,1,8
  240 REM clear paper
  250 VDU1,10,1,10,1,10
  260 FOR Y%=1023 TO 0 STEP -16
  270 REM send bit code (ESC L 192 3 - 960 dots per line or 640 dots for MODE0)
  280 VDU1,27,1,76,1,n1,1,n2
  290 FOR X%=0 TO 1279 STEP step_size
  300 !Xlo=X%+Y%*&10000
  310 ?pass=0
  320 CALL pixel
  330 NEXT
  340 VDU1,10
  350 NEXT
  360 REM reset linefeed and disable printer
  370 VDU1,27,1,65,1,12,1,12,3
  380 END
  390 DEFPROClimits
  400 DIM user 3
  410 A%=&87
  420 !user=USR(&FFF4)
  430 mode=user?2
  460 IF mode>5 OR mode=3 THEN graphics=FALSE ELSE graphics=TRUE
  470 IF mode=0 THEN n1=128:n2=2 ELSE n1=192:n2=3
  480 IF mode=0 THEN step_size=2:?pass_number=1:?&80=pattern0 MOD 256:?&81=patte
rn0 DIV 256
  490 IF mode=4 THEN step_size=4:?pass_number=3:?&80=pattern4 MOD 256:?&81=patte
rn4 DIV 256
  500 IF mode=1 OR mode=5 THEN step_size=4:?pass_number=3:?&80=pattern1 MOD 256:
?&81=pattern1 DIV 256
  510 IF mode=2 THEN step_size=8:?pass_number=6:?&80=pattern2 MOD 256:?&81=patte
rn2 DIV 256
  520 ENDPROC
  530 DEFPROCassemble
  540 osword=&FFF1
```

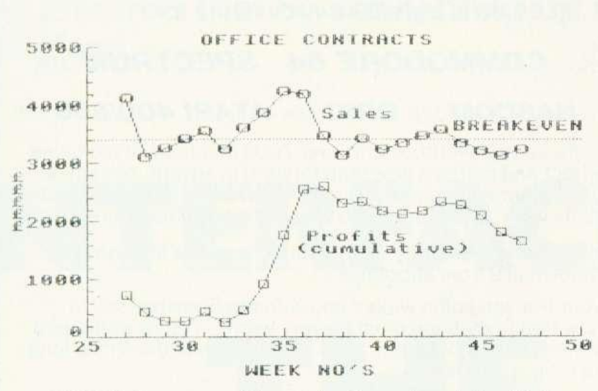
continued on page 75

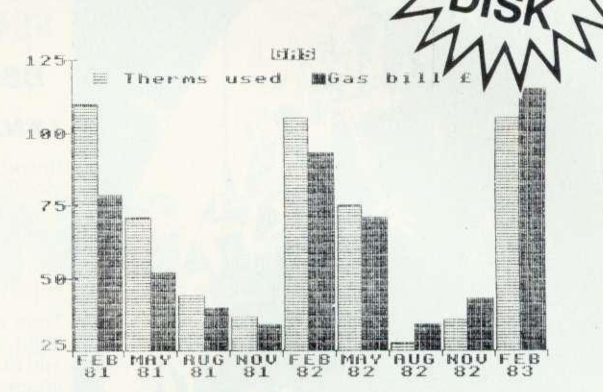

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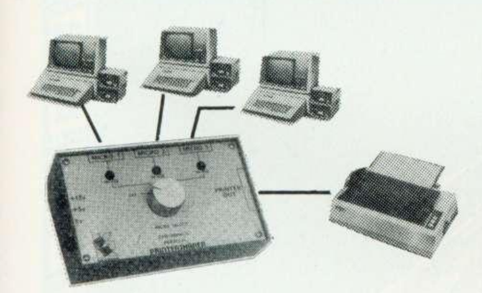
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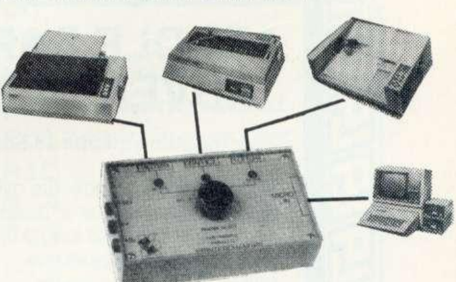
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SNOWBALL IX
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Paul Beverley and Martin Hosken set you off on the Electron trial by connecting up a 6522 interface

INTERFACING THE ELECTRON

WHEN I first saw the Electron, I was a little disappointed to find it did not have a user or printer port. The only external interfacing (apart from cassette and TV/monitor outputs) is the edge connector on the back of the computer. Therefore the first job was to connect a 6522 versatile interface adaptor so people could start wiring up various devices to their Electrons.

Before getting started, let me first look at a way of communicating between a disc-based BBC micro and the Electron, so you can load in all the programs you use with the Electron from disc. Unfortunately, the Electron does not have an RS423 serial interface which can transmit at 9600 baud, so the only way of getting programs from one to the other, apart from a device which uses the edge connector, is to use the cassette port. Although this does not give any increase in speed over loading directly from cassette, it does mean you don't have to store programs actually on cassette.

Connection between the two cassette ports is simplicity itself. All you need is a piece of twin-core screened cable to connect together two five-pin (or three-pin) DIN plugs and cross over the connections (figure 1). You will also need a resistor between each of the lines and earth to get each micro to accept output from the other. These can be fitted, with careful soldering, one inside each of the DIN plugs, though this is fairly fiddly.

An extremely neat, if expensive solution, courtesy of Acorn, is to use two standard cassette leads and link them together in the middle with two PCB mounting sockets placed back-to-back on a piece of Veroboard. This automatically reverses the connections, and the resistors can be mounted on the board. This does not require a special lead which can only be used for back-to-back connection.

The resistor value chosen (1.5kohm) was suggested by one of Acorn's engineers

Figure 1. Connecting the cassette ports of the BBC micro to Electron (also works BBC to BBC)

```
 1 18V AC in
 2 18V AC in
 3 18V AC return
 4 18V AC return
 5 -5V
 6 -5V
 7 GND
 8 GND
 9 +5V
10 +5V
11 Sound output
   (TTL levels, 1.8k
   ohms impedance)
12 16 MHz
13 16 MHz divided by 13
14 Clock output
15 RESET
16 NMI
17 IRQ
18 R/W
19 D7
20 D6
21 D5
22 D4
23 D3
24 D2
25 D1
26 D0
27 RDY
28 No connection
29 Polarising slot
30 Polarising slot
31 A15
32 A14
33 A13
34 A12
35 A11
36 A10
37 A9
38 A0
39 A1
40 A2
41 A3
42 A4
43 A5
44 A6
45 A7
46 A8
47 GND
48 GND
49 +5V
50 +5V
```

Figure 2. Details of the edge connector. Odd numbers are on the top, and the numbering starts from the side nearest the power supply

ROMS

SOFTWARE FOR THE BBC MICRO

```
WORDWISE
(C) Computer Concepts 1982

1) Save entire text
2) Load new text
3) Save marked text
4) Load text to cursor
5) Search and Replace
6) Print text
7) Preview text
8) Spool text

ESC Edit Mode

Please enter choice_
```

WORDWISE 32K

The renowned word processing package. Still clearly the market leader with sales now over 20,000. This has become "the standard" word processor for the BBC Micro and is still receiving very favourable reviews. Wordwise will work with tape, disc or Econet and includes automatic word counting and full control over text entered into the system. Supplied with a detailed spiral bound manual and an excellent free typing tutor program. After 8 months on the market there is still no other product as simple to use and as powerful as Wordwise.

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```
   A=FF     X=FF     Y=FF
S =01FF 88 10 E3 BF 92 93 DC 89
PC=FFFF DC FF FF 09 D0 00 00 FF
        ???
   CFF0 48 4A 4A 4A 4A AA BD 1F HJJJJ
   CFF8 C3 05 D2 45 D3 91 D8 98    E
M =D000 18 69 08 A8 68 29 0F AA  i  h)
   D008 BD 1F C3 05 D2 45 D3 91      E
   D010 D8 98 E9 08 A8 10 D7 60         £
   D018 98 E9 21 30 FA A8 B1 DE   !0
------------------------------------------
! START=D000
!D START START+9 S
D000 18             CLC
D001 69 08     i    ADC #8
D003 A8             TAY
D004 68        h    PLA
D005 29 0F     )    AND #F
D007 AA             TAX
D008 BD 1F C3  ...  LDA C31F,X

!LVAR
START D000
!$M START
```

GREMLIN 32K

The GREMLIN system is a powerful de-bugging tool for 6502 machine-code programs. It includes all the usual features found in good machine-code monitors, such as memory search, intelligent memory move routines, memory editors etc. These work at byte, word or string level. A built in help menu can also be displayed at any time.
This ROM contains many more unique features such as an assembler as well as a disassembler. An extremely powerful expression evaluator is included allowing complex expressions to be entered in a format that is only normally available in high level languages. Variables are also allowed (any length) and may be included into expressions.
GREMLIN allows single stepping through machine-code programs. It is also possible (on to a printer or disc) to single step through graphic routines without disturbing the screen.
Supplied with full manual, this 8k ROM has more features than any other de-bugging package for the BBC machine.

£28.00 + £1.00 p&p + VAT

```
DISC DOCTOR 1.07
  DIS <<sta>> <<end>> <<ofs>>
  DISCTAPE <afsp> <<afsp>>
  DOWNLOAD <fsp> <<adr>>
  DSEARCH <str> <trk> <<trk><sct><drv>>
  DZAP <<trk>> <<trk><sct><drv>>
  EDIT <<key no.>>
  FIND <str>
  FORM <drv> <no. trks> <<stt>> <<S>>
  JOIN <fsp> <afsp> <<afsp>>
  MENU <<drv>>
  MOVE <<dest page>> <<src page>>
  MSEARCH <str> <<adr>>
  MZAP <<adr>>
  PARTLOAD <fsp> <ofs> <ext> <adr>
  RECOVER <trk> <sct> <sct> <adr> <drv>
  RESTORE <trk> <sct> <sct> <adr> <drv>
  SHIFT <src> <dest> <ext>
  SWAP <<drv>>
  TAPEDISC <<fsp>>
  VERIFY <<drv>> <<no. trks>> <<stt>>

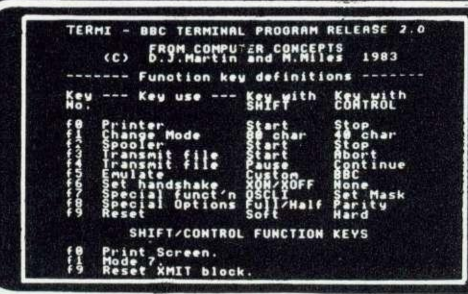
OS 1.20

Press any key.
```

DISC DOCTOR 32K

This utility package has many special features for use with discs but also contains many other utilities that everyone will find useful: Function key editing, powerful disassembler, recovery of any data from the disc, merging of files, complete disc editor. Compatable memory editor, String search in memory or on disc, automatic tape to disc and disc to tape routines, built in help menus, formating of 35, 40 and 80 track discs, and also a special format that allows 60 files per disc.

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TERMI 32K

This program enables the BBC machine to act as an advanced terminal when connected to another computer or to a modem via the RS-423 (RS-232) interface. This provides facilities to transmit data from disc and the spooling of data from the 'line' to the disc or printer.
Termi has 3 modes of operation — dumb terminal, BBC graphics terminal and customised intelligent terminals including DEC VT52.

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and represents a compromise. The optimum value depends on the coupling capacitor in the cassette output which, on older BBC machines (issue 3 PCBs and earlier) was 47nF while on newer ones and on the Electron itself, it is 220nF. With the smaller capacitor, it seems to work with a resistor anywhere between 500ohms and 10k, while with the larger capacitor, a correspondingly smaller value is needed. A 1.5k resistor should work in all cases. However, if you have difficulty loading or saving, a lower value of resistor would be likely to improve matters, if it was a newer BBC machine or the Electron that was sending.

The reason for the resistor is that it corrects the relative phase shift of the two different frequency components that make up the signal.

This then, enables you to tell the BBC to save a program and at the same time tell the Electron to load a program, and the program will then be transferred from the BBC to the Electron. If you then develop the program on the Electron, and want to put it back onto disc, you would use exactly the reverse process—tell the Electron to save and the BBC to load, change to the disc filing system and then save the program back onto disc. To make life simpler you could program function keys on the micros as follows:

On the BBC micro:

```
*KEY0 *D.|M LOAD"
*KEY1 |M *T.|M SAVE"PROG"|M|M
*KEY2 *T.|M LOAD""|M *D.|M SAVE"
```

On the Electron:

```
*KEY9 LOAD""|M
*KEY1 SAVE"PROG"|M|M
```

To get a program from the BBC disc into the Electron, you press f0 on the BBC, type in the program name, close the quotes and press f1. You should then quickly press <func>f9 on the Electron and wait for the program to load across. To save the program back from the Electron to the BBC you should press f2 on the BBC micro and then f1 on the Electron. When the program has loaded across into the BBC, you type in the new file name, close the quotes and press return. The program will then be saved on the BBC disc.

There are two problems with interfacing to the Electron. The first is that, at the time of writing, Acorn has not released the information about the pin connections on the edge connector. However, it is not too difficult to work out the various connections for yourself by removing the circuit board and tracing the tracks back to the 6502 processor. If you did this, you would find the connections were as shown in figure 2. (The engineers at Acorn were kind enough to check my connection list).

The numbering system used works from the side nearest to the power supply, odd numbers being on the top of the board and even numbers underneath (and this happily agreed with the way Acorn had done it). It is easy to work out which end is which since the 18volt connections are adjacent to the power supply which is at the right hand side of the computer as you sit in front of it. It is obviously important to get the connector the right way round since the other end of the connector carries the ground and +5volts!

Having worked out these connections, there is still a problem associated with the clock on the 6502. This was outlined in the second of the two articles about the Electron which appeared in the September issue. The 6502 processor on the Electron is sometimes working at 2MHz, sometimes at 1MHz and sometimes is totally stalled. The change from 2MHz to 1MHz is similar to what happens on the BBC micro except

16MHz
74LS93
÷2
÷8
6502 RESET
RESET
6502 R/W
clock in on 6522 (1MHz)
6502 clock output
74LS74
A15 A14 A13 A12 A11 A10 A7 A6
NCS2 (6522 pin 24)
74LS30
A9 A8 A5 A4
CS1 (6522 pin 24)
½ 74LS25
Address decoded = &FCCX

Figure 3. Theoretical circuit diagram (6522 addressed at &FCC0 to &FCCF)

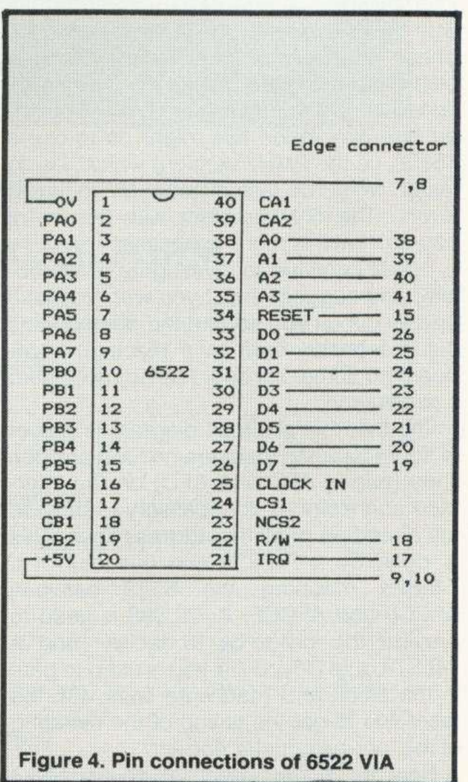


Figure 4. Pin connections of 6522 VIA

that it occurs more often on the Electron since its RAM is accessed at 1MHz rather than 2MHz.

In the higher graphics modes, during the active line scan, the 6502 is stalled, since the ULA has total control of the RAM to provide video information at a high enough rate. Therefore, during this time, no clock pulses appear at the clock output pin. Thus if you want to run a device such as a 6522 VIA you have to 'reconstitute' the clock. This is not necessary to achieve simple access to the registers on the VIA, but it is necessary to be able to use the counter/timers or the shift register, since these need a constant 1MHz clock.

It is easy enough to take the 16MHz clock signal from the edge connector and divide it by 16 using a four-bit binary counter. However, it is essential for the correct execution of data transfers between the 6502 and the 6522 that the 1MHz should be in phase with the main clock. To do this, the divide-by-16 counter is synchronised with the read-write line and the 6502 clock output whenever a reset occurs. Thus, the counter is synchronised when a power-up reset occurs and also when the break key is pressed.

The phase of the 1MHz signal produced by the counter seems to remain in the correct relationship to the system clock as far as I can tell, although it is difficult to check without a digital storage scope. I am not entirely happy with my design since it is based on the fact that it works so far, but not having any official information about the internal workings of the Electron makes it difficult to do much else. The Acorn engineers who are working with the Electron were keen to help, but could not actually give away the secrets of their own interface (and it *does* work). Their verdict was that they were not convinced that the phase relationship between the Electron clock and the 6522 clock would be maintained in all circumstances. They suggested one way round this might be to use a 6522A (ie the 2MHz version) which, being faster, would be less susceptible to timing errors. The only problem with this is, of course, that it is more expensive.

I shall continue to investigate this problem, and suggest that if you want to make up this circuit you spread the components out reasonably well on a piece of Veroboard so some of it could be adjusted later if necessary!

The theoretical circuit diagram is shown in figure 3. Since there are no Fred and Jim lines (pages &FC and &FD) on the interface connector, it is necessary to provide full decoding of all the address lines. This is done by a 74LS30 and one half of a 74LS25 mapping the 6522 between &FCC0 and &FCCF. A 74LS93 is used to provide the divide-by-16 facility, and a 74LS74 dual D-type flip-flop is used to gate in the clock and read/write lines with the reset line to get the timing of the resetting of the four-bit counter correct.

Now for a few practical points about constructing this interface. The prototype was built on Veroboard and connections were made between the board and the edge connector using ribbon cable. The edge connector itself (50 way, double sided – 0.1" spacing) came off a scrap computer board.

The pin connections for the 6522 and their links to the edge connector are shown in figure 4. A practical layout for the address decoding chips is shown in figure 5, and for the clock generation circuit in figure 6.

The power supply lines should be decoupled at two or three points around the board by connecting 100nF capacitors between +5V and 0V.

One important thing to try to do with the VIA is to use it to implement a Centronics standard parallel printer port. The hardware involved could be copied from the BBC *User Guide*, page 503. It consists of a 74LS244 buffer, a driver transistor on CA2, and a 4k7 pull-up resistor on CA1. The problem from my point of view is the software. I feel sure it must already be in the operating system—if I can only find it!

One project I am working on is some software which should enable you to connect one of the ports on the VIA to the printer port of a BBC micro, so that to transfer a program you just tell the BBC to list it. This would then allow you to download programs at a much higher speed than is possible through the cassette port. Read next month's *Acorn User* for the next exciting chapter of the Electron Interfacing Saga!

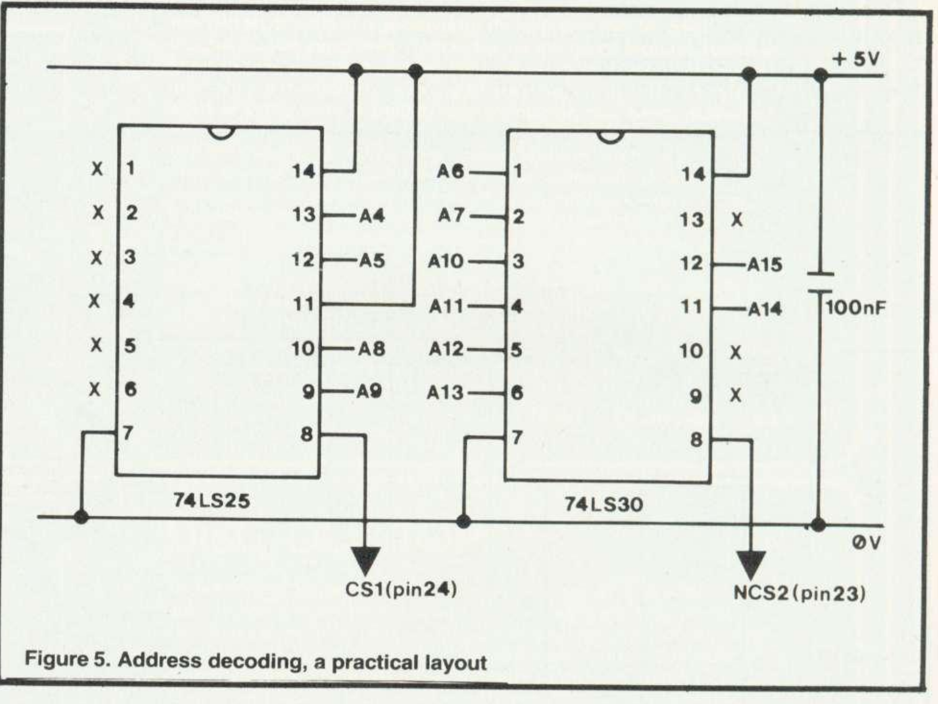


Figure 5. Address decoding, a practical layout

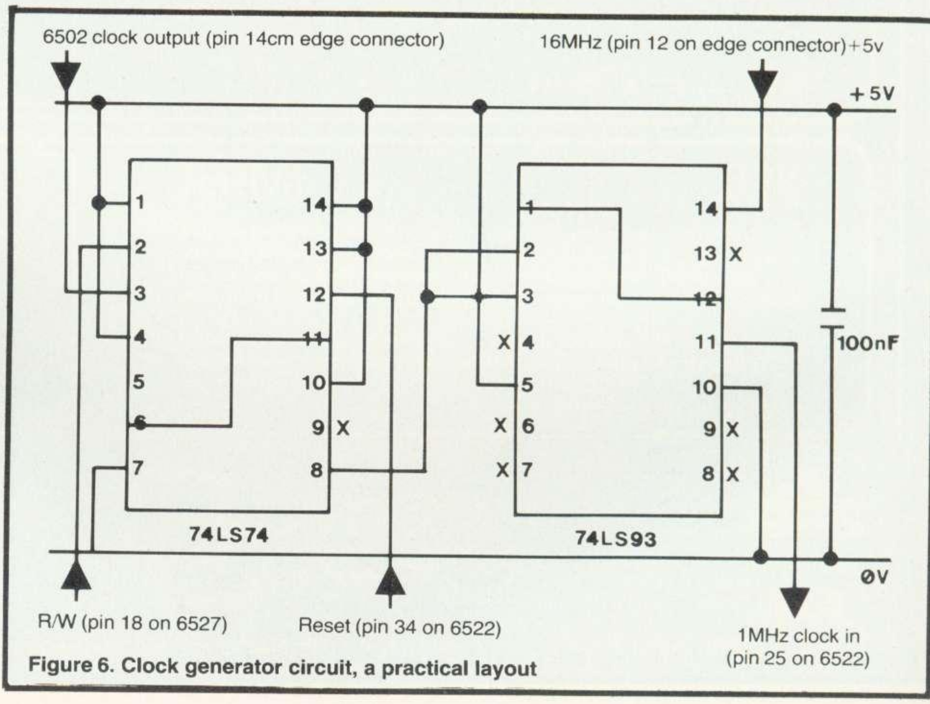


Figure 6. Clock generator circuit, a practical layout

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PRIME SUSPECTS

Simon Dally goes back to the dawn of time to underline the futilities of human endeavour

SINCE the dawn of learning mathematicians have directed the full firepower of their analytical artillery into drawing up laws which will help classify the chaotic subject of prime numbers. So far all promising beginnings have been brought to nought, though there are many tantalising avenues to explore. Certainly no one has yet been able to produce a coherent relationship within the sequence of prime numbers – and not for lack of trying!

A prime number is, of course, a number exactly divisible only by 1 and by itself. All numbers are therefore either prime or composite: either they can't be divided exactly (except by 1 and themselves) or they're exactly divisible by a prime number.

You might think that the higher you look, the fewer the prime numbers you can find – and you'd be right. Nevertheless, it was Euclid who first produced the rather elegant proof that the number of primes is infinite.

In essence, Euclid's proof states that if the number of primes is *not* infinite then there must be a highest prime number (let's call it prime%). We can now compute a number (number%) by multiplying together all the primes up to and including prime%. Thus our number would be 2*3*5*7*11, up to and including prime%. If you now add 1 to number % you have a number which when divided by any prime number leaves a remainder of 1 (since number% is divisible by them all).

There are now only two possibilities concerning the status of number%+1:

- Since it isn't divisible by any number smaller than itself it must be a prime number.
- If it isn't a prime number then it must be divisible by a prime larger than the highest prime used to create number%.

Whichever of these roads you go down you have proved there is a higher prime number than prime%. In the first case, number%+1 must be much higher than prime%, while in the second case we have already defined the highest prime as prime%, so we can't have a higher one.

Another Greek mathematician, Erastothenes, came up with a simple method of tabulating all prime numbers below a given number. It works by writing down all the integers from 1 to your fixed number (let's say 30). Starting at 2 (but leaving 2 uncrossed), you cross off every second number up to 30. Then start at the first uncrossed number (3) and cross off every third number (but leave 3 uncrossed). 4 has already been crossed off but 5 hasn't so, starting at 5 (but leaving 5 uncrossed), you cross off every fifth number. The next uncrossed off number is 7 – and so on.

Finally the result looks like this (the 11 uncrossed numbers are primes):

1 2 3 ~~4~~ 5 ~~6~~ 7 ~~8~~ ~~9~~ ~~10~~ 11 ~~12~~ 13 ~~14~~ ~~15~~ ~~16~~ 17 ~~18~~ 19 ~~20~~ ~~21~~ ~~22~~ 23 ~~24~~ ~~25~~ ~~26~~ ~~27~~ ~~28~~ 29 ~~30~~

The problem with the Sieve of Erastothenes (*Acorn User* April) is that it's very slow by hand – and although considerably faster with a computer it isn't going to get you into the trillions very quickly. However, it is elementary to write a short program to perform the task.

Notwithstanding the tedium in factorising large bodies of numbers, there is something humbling in considering the history of humans who have devoted their lives to establishing which numbers are prime and which are composite.

Take the Austrian Antonio Felkel, for example. In 1776 he published in two volumes the results of his endeavours, the prime factors of all numbers up to two million. Volume I sold no copies at all and only a handful of copies of the entire edition escaped being turned into cartridges for use in the Turkish war. When he attempted to retrieve his work the publishers had either lost the manuscript or refused to part with it and he had to recalculate all the factors of the numbers from 408,000 upwards!

The work of Kulik is even more difficult to comprehend. Over a period of 20 years he produced without assistance a factor table for all numbers up to one hundred million. The work, placed in the Royal Academy of Vienna, ran to eight volumes.

As if to underline the futility of human endeavour, Volume II, which runs from 12,642,600 to 22,852,800, is missing. In the words of the great number theory expert, Albert Beiler, 'What careless custodian, what heedless dusting woman, what furtive student was responsible for the loss?'

Nor can we know what induced people such as Kulik and Felkel to spend their lives in this solitary pursuit – certainly there was no material reward to be grasped, nor likely to be one within their lifetime.

Less sentimental readers may take a more positive view of human progress and calculate how long it would take their microcomputers to duplicate the work of Felkel and Kulik – an evening of programming, perhaps, and then let the computer get on with it. . .

The age of computers has done little to bring any laws into the subject of prime numbers and their relationships, although it has advanced our knowledge of what numbers are prime. Flicking through books on mathematics I noticed that a volume published in 1944 expects the reader to be impressed by the prime number $(2^{127})-1$. It was suspected of being prime for several years before being proven to be so. It is 39 digits long, a figure thought by 17th century mathematicians to be beyond human capacity to analyse. And yet it is chickenfeed for a micro and a few mathematical subroutines!

After the war when only a few computers had been built people interested in number theory took to 'borrowing' computer time for the weekend and things started hotting up. By 1963 the highest know prime was $(2^{11213})-1$, a number which has 3376 digits. This took a digital computer at Illinois 135 minutes to verify, making 1.25 billion multiplications and additions in the process – equal to 125 people working non-stop for 1000 years.

A 1979 textbook declares the highest known prime to be $(2^{21701})-1$, and early this year it was shown that $(2^{86243})-1$ is prime. To verify this last prime it took one of

the world's largest computers – the giant Cray 1 at the Cray Research Laboratories, in America – 63 minutes, and months of computing on other machines had been spent by its discoverer, David Slowinski, beforehand.

It contains 25,962 digits so if printed here it would take up approximately four pages of *Acorn User*. That makes the number sound almost manageable, though in fact if you placed this number of coins on top of each other the pile would extend far beyond the boundaries of the universe.

If that sounds implausible just recall the old puzzle of the sheik who agreed to reward a good and trusty servant by giving him a grain of wheat on the first square of a chessboard, two grains on the second, four grains on the third, and so on, so that on the sixty-fourth square he had to place 2^64 grains of wheat. That figure exceeds by a factor of several thousand the current world annual production of wheat.

Most research into prime numbers leaves one either confused or likely to become obsessed. However, for those with time on their hands, here are some avenues to explore.

- It has been said that there are an infinite number of 'twin primes', which differ by 2. Some examples are 11:13, 137:139, 21377:21379. Most mathematicians believe the statement is likely to be true but no one has proved it.
- Pierre de Fermat (1601-1665) believed he had found a method of generating prime numbers: where n is a whole number, then 2^(2^N)+1 is a prime. Thus:

$2^{2^n}+1$ for $n=0$ $2^1+1=3$
$n=1$ $2^2+1=5$
$n=2$ $2^4+1=17$
$n=3$ $2^8+1=257$
$n=4$ $2^{16}+1=65{,}537$

(Note that any number – excluding 0 – to the power of 0 equals 1.)
Although Fermat came to doubt his proposition, it was a hundred years before someone else showed that the next number in the sequence – 4,294,967,297 – is not prime, and it has since been shown there are other Fermat numbers which are not prime. The question is, are there *any* Fermat numbers beyond these first five which are prime?

- Another 'formula' for generating primes is n^2+n+41, where n is a whole number. Start with n set at 0 and see how many primes you get as you increase it. The result is really remarkable and shows the dangers in mathematics of deducing laws from impressive data alone.
- A mathematician called Goldbach observed that every odd number is either a prime or the sum of a prime and twice a square. Thus 27=19+8 and 21=13+8 or 19+2.

There are two exceptions to this below 9000 (exclude 0). Can you find them?

- Below 10,000 every number, both odd and even, with only one exception, can be expressed as the sum of a prime and a power. Thus $588=463+5^3$. Can you find the odd one out?

UNDER 13s

The French mathematician, Fermat, mentioned in the text, was able to reply to a letter enquiring whether or not the number 100,895,598,169 was prime on the same morning he received it. It isn't. According to *Mathematics and the Imagination*, published by Penguin Education, 'A mathematician, even today, might spend years hunting for the correct answer'. This statement is somewhat misleading.

See how long it takes you to find the correct answer.

THIS MONTH'S PROBLEMS

FOR ALL AGES

In the following table of random prime numbers find the largest number you can by adding 13 numbers. No more than one number may be used from any horizontal row or any vertical column – though, of course, if a number appears twice it can be used twice, provided the row/column rule isn't violated.

Send your entry in with the numbers circled (a copy or photocopy will do if you don't want to cut the magazine) and include the total at the bottom. We'll publish the best program listing submitted (if it's short enough).

Send you answers to December Competition, *Acorn User*, 53 Bedford Square, London WC1B 3DZ to arrive not later than January 6 1984.

461	827	359	401	521	971	607	313	919	601	953	431	673
461	809	389	127	229	613	991	653	719	463	691	419	521
269	463	967	367	613	619	347	151	839	509	631	167	251
617	373	421	229	769	631	607	521	857	797	569	947	389
449	769	673	683	257	647	593	277	523	353	269	193	827
389	577	821	821	271	499	379	229	421	991	449	307	347
257	263	467	107	163	829	311	643	947	751	229	541	661
719	277	197	673	659	503	769	673	229	131	971	233	821
877	661	653	263	571	199	613	761	503	653	281	317	193
919	983	269	739	271	709	751	167	421	701	577	761	443
443	433	313	929	983	397	937	359	401	947	487	709	457
857	397	593	641	541	977	257	521	457	421	853	911	229
149	673	107	239	179	419	107	397	499	683	643	379	811

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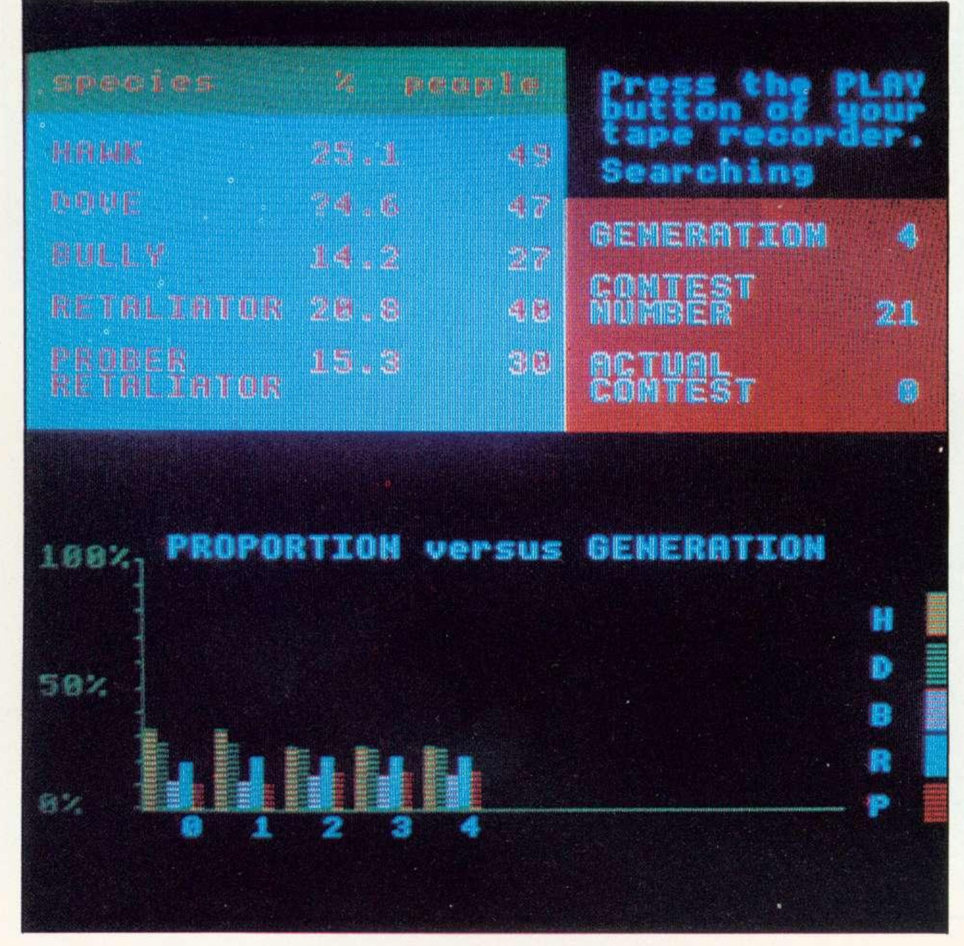
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£1,100 PRIZE WINNER

THE Hawks and Doves competition in our June and July issues prompted about 300 of you to send in programs – we never cease to be astonished at your productivity – even though £1,100 was at stake! The chief conclusions which about 90% of you reached in one form or another were:

- In a hawk-dove society the population stabilises at a ratio of seven doves to five hawks.
- When bullies arrive on the scene they edge the doves out to become non-existent for practical purposes (remember, you weren't allowed to eliminate any type) and the ideal ratio is 50:50.
- A society composed of hawks and bullies exclusively is more stable than one where other strategies such as prober-retaliator and retaliator come in on the scene.

Most programmers inevitably made some sort of compromise between attractive graphics and speedy operation from generation to generation – and because the overall standard was very high indeed, it wasn't easy for us to decide who should get the prize. In the end the editor plumped for Miguel Angel Gonzalez Munoz, from Asturias, Spain. The two runners-up were N Cox from Ashford, Middlesex, and Mark Williams from Sutton Coldfield, West Midlands.

Simon Dally

COMPETITION

WIN £1,100

Acorn system: BBC micro with single disc drive ink-jet printer plus software

The competition comes in two parts – you are recommended to enter both parts. This month we introduce you to our hawk-dove micro-world and ask you to determine a character mix which will set up a stable society. Next month, the model society gets more complicated with more characters and you will have to write a computer program (on cassette) to simulate the hawk-dove society

Simon Dally launches you into a Hawk-Dove microworld in the first part of our major quiz. The full blown idea will be a mammoth task, so we suggest you start thinking and get some practice. This month: Solve our simple computer model and you could win the first prize of £50 of software, or a runner's-up award of a copy of The Selfish Gene.

Next month: Analyse our full-blown model and produce a computer program (on cassette) to simulate it, complete with graphics. Entries will be assessed on how well the program works, structure and presentation (among other things, so we don't limit your imagination).

Remember: Whether you enter this month's simple competition or not, you must give the answers with your program next month to qualify for the big £1100 prize.

Three winners in February quiz

COMPETITION

WIN £1100

Disc system
- ☐ BBC micro
- ☐ Single drive
- ☐ Ink-jet printer

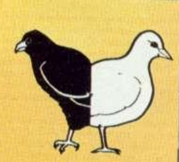
Simon Dally presents the second part of our Hawk Dove Competition. Last month he introduced the idea, now we refine it and ask you to produce a piece of software. The behaviour of our animal world is open to interpretation, and this will be taken into account when choosing the winner.

Once you've written your software, and answered last month's quiz, send it to Acorn User, 53 Bedford Square, London WC1B 3DZ. Entries should arrive by Wednesday, August 3 and must be clearly marked 'Hawks and Doves'.

The overall winner will receive: BBC model B fitted with disc interface; single disc drive; Olivetti ink-jet printer.

Two runners-up will each receive software to the value of £50. A copy of The Selfish Gene, the inspiration of this competition, will also go to each winner. The result will be announced in November's Acorn User, and winners will be notified by post.

Our thanks to Acorn, Richard Dawkins and Oxford University Press for their help with the competition.





The Selfish Gene by Richard Dawkins, OUP, £8.50

AS Simon says, it was no easy task picking the overall winner, and all three finalists covered themselves in glory – as did many others.

In the end, however, the major prize – BBC micro, disc drive and printer, go to Miguel because of the quality of programming, graphics and robustness of the software.

Mr Cox deserves a special mention for his interpretation of the bird conflicts, and Mark for some excellent use of graphics, especially in the title page.

Unfortunately, Simon Dally has flown off to America with the winning entries from the first part of the competition – so look out next month for the news.

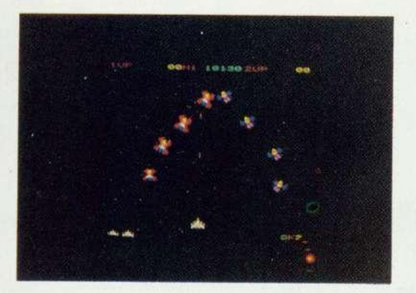
Tony Quinn

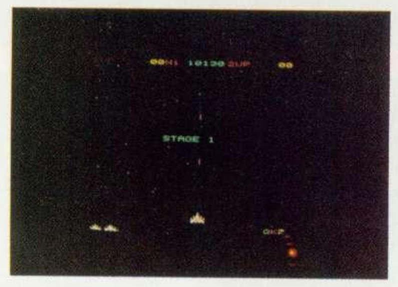
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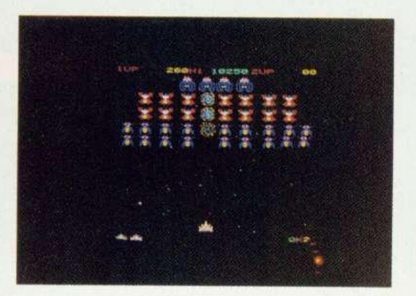
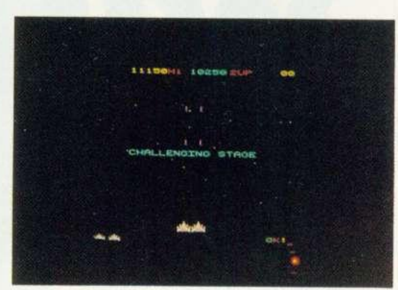
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FRAK coming soon . . .

Program 3 continued from page 58

```
550 oswrch=&FFEE
560 Xlo=S%
570 Xhi=S%+1
580 Ylo=S%+2
590 Yhi=S%+3
600 value=S%+4
610 byte=S%+5
620 pass=S%+6
630 count_4=S%+7
640 S%=S%+8
650 FOR opt=0 TO 2 STEP 2
660 P%=S%
670 [OPT opt
680 \SUBROUTINES
690 \to calculate POINT(X,Y)
700 .point          ldx #Xlo MOD 256
710                 ldy #Xlo DIV 256
720                 lda #9
730                 jsr osword
740                 rts
750 \subroutine to print a character
760 .printchar      lda #1
770                 jsr oswrch
780                 lda byte
790                 jsr oswrch
800                 rts
810 \decrement Y by 4
820 .dec_Y4         sec
830                 lda Ylo
840                 sbc #4
850                 sta Ylo
860                 bcc dec_Yhi
870                 rts
880 .dec_Yhi        dec Yhi
890                 rts
900 \increment Y by 16
910 .inc_Y16        clc
920                 lda Ylo
930                 adc #16
940                 sta Ylo
950                 bcs inc_Yhi
960                 rts
970 .inc_Yhi        inc Yhi
980                 rts
990 \to rotate in two bits. Enter with X=pass, Y=colour.
1000 .two_bits      lda (&80),Y        \select appropriate byte of pattern
1010                cpx #0             \if pass is 0 rotate
1020                beq rotate_in      \next two bits in
1030 .rotate_out    ror A              \otherwise dump two bits
1040                ror A
1050                dex                \has X reached 0?
1060                bne rotate_out     \if not dump two more
1070 .rotate_in     ror A              \if so next two bits go into byte
1080                rol byte
1090                ror A
1100                rol byte
1110                rts
1120 \to calculate a whole byte
1130 .one_byte      jsr point
1140                ldy value
1150                lda pass
1160                and #3
1170                tax
1180                jsr two_bits
1190                jsr dec_Y4
1200                dec count_4
1210                bne one_byte       \if byte incomplete go back
1220                jsr printchar      \print the byte
1230                rts
1240 \MAIN PROGRAM
1250 \to calculate and print the pattern for one pixel
1260 .pixel         lda #4
1270                sta count_4        \reset counter
1280                jsr one_byte
1290                jsr inc_Y16
1300                inc pass
1310                lda pass
1320                cmp pass_number
1330                bne pixel
1340                rts
1350 ]
1360 NEXT
1370 ENDPROC
```

***SAVE has limitations – but they can be overcome, says George Hill**

SAVING MACHINE CODE

IT CAN be difficult using the SAVE command, especially because of the inability of the * commands to cope with even the simplest variable (like TOP). I now use PROCsave_it to avoid the pitfalls.

All the * commands require that the line of text following them can be interpreted literally. This means that to *SAVE a bit of machine code you have to type (for instance):

*SAVE"NAME"1900 +300 1B21

as a literal string. The operating system routine being called cannot cope with variables. Thus the line

*SAVE"NAME"PAGE+(TOP−PAGE) exec_address

is incomprehensible to OSCLI, the command line interpreter.

PROCsave_it (program 1) prepares a string for OSCLI at location command_line, and when called saves the machine code to tape or disc automatically.

OSCLI is described in the *User Guide* on page 463. The X and Y registers (via X% and Y%) 'point to' the address of the string prepared at command_line. When OSCLI (at address &FFF7) is called the string is interpreted, and passed in the correct form to the required operating system routine. *SAVE will invoke the OSFILE routine indirectly.

Preparation of the string comes in three parts (like Gaul, for those with a classical education):

- The letters SAVE.
- Filename, surrounded by inverted commas.
- Hexadecimal values of the three addresses, separated by spaces.

The first two parts are simply dealt with in lines 10090 to 10130. The preparation of the strings from the numerical values of the addresses is taken care of by PROC hex-string(NUMBER). This prepares a string from any number passed to it in the range 0 to 65535 (&FFFF).

All that remains is to make sure that your assembly language program produces the following self-explanatory variables:

start_address
end_address
exec_address

Program 2 is a short piece of assembly language to print a message on the screen. It generates start_address automatically by setting it at line 140. Then end_address is produced as the final value of P% (line 350). The execution address (deliberately moved from the start of the code to simulate real conditions) is generated by the label .exec_address.

The assembly language is written and tested (line 100). SAVEIT is merged on by using:

P. TOP−2
(result is LLLL)
*LOAD"SAVEIT"LLLL

or by the *SPOOL method (*User Guide* page 402). Now replace line 100 by:

100PROCsave_it

and the machine code will be saved for you when you RUN the program.

```
10000 REM *** SAVEIT ***
10010 REM Procedure to automatically *SAVE assembled code
10020 REM G.B.Hill September 1983
10030 DEFPROCsave_it
10040 oscli=&FFF7
10050 DIMcommand_line 32
10060 DIM H$(4)
10070 H$=""
10080 hex_chars$="0123456789ABCDEF"
10090 INPUT"Type in filename for assembled program "'filename$
10100 REM Cut filename to 7 characters, and insert inverted commas.
10110 filename$=CHR$34+LEFT$(filename$,7)+CHR$34
10120 PROChex_string(start_address)
10130 $command_line="SAVE"+filename$+H$
10140 PROChex_string(end_address)
10150 $command_line=$command_line+" "+H$
10160 PROChex_string(exec_address)
10170 $command_line=$command_line+" "+H$
10180 X%=command_line MOD 256
10190 Y%=command_line DIV 256
10200 CALLoscli
10210 ENDPROC
10220
10230 DEFPROChex_string(NUMBER)
10240 FOR I=1 TO 4
10250 N=(NUMBER MOD 16)+1
10260 H$(I)=MID$(hex_chars$,N,1)
10270 NUMBER=NUMBER DIV 16
10280 NEXT
10290 H$=H$(4)+H$(3)+H$(2)+H$(1)
10300 ENDPROC
```

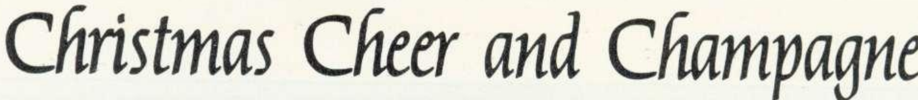
Program 1. Automatically *SAVEs assembled code

Figure 1. Result of merging

```
   10 REM *** MESSAGE ***
   20 REM Program to generate
      example machine code
   30 REM G.B.Hill Sept1983
   40 REM PROGRAM START
   50 REM OS addresses
   60 oswrch=&FFEE
   70 REM Locate program where
      required. This puts it
      at the top of memory
   80 S%=HIMEM-&100
   90 PROCassemble
  100 PROCsave_it
  110 END
  120
  130 DEFPROCassemble
  140 start_address=S%
  150 message=S%
  160 $message="The code has now
      been saved"+CHR$13+CHR$10
  170 S%=S%+29
  180 FOR opt=0 TO 2 STEP 2
  190 P%=S%
  200 [OPT opt
  210 \subroutine to print message
  220
  230 .print_msg     ldx #0
  240                ldy #29
  250 .loop          lda message,X
  260                jsr oswrch
  270                inx
  280                dey
  290                bne loop
  300                rts
  310 \main program
  320 .exec_address jsr print_msg
  330                rts
  340 ]
  350 end_address=P%
  360 NEXT
  370 ENDPROC
10000 REM *** SAVEIT ***
10010 REM Procedure to automatically
      *SAVE assembled code
10020 REM G.B.Hill September 1983
10030 DEFPROCsave_it
10040 oscli=&FFF7
10050 DIMcommand_line 32
10060 DIM H$(4)
10070 H$=""
10080 hex_chars$="0123456789ABCDEF"
10090 INPUT"Type in filename for assembled
      program "'filename$
10100 REM Cut filename to 7 characters,
      and insert inverted commas.
10110 filename$=CHR$34+LEFT$(filename$,
      7)+CHR$34
10120 PROChex_string(start_address)
10130 $command_line="SAVE"+filename$+H$
10140 PROChex_string(end_address)
10150 $command_line=$command_line+" "+H$
10160 PROChex_string(exec_address)
10170 $command_line=$command_line+" "+H$
10180 X%=command_line MOD 256
10190 Y%=command_line DIV 256
10200 CALLoscli
10210 ENDPROC
10220
10230 DEFPROChex_string(NUMBER)
10240 FOR I=1 TO 4
10250 N=(NUMBER MOD 16)+1
10260 H$(I)=MID$(hex_chars$,N,1)
10270 NUMBER=NUMBER DIV 16
10280 NEXT
10290 H$=H$(4)+H$(3)+H$(2)+H$(1)
10300 ENDPROC
```

```
   10 REM *** MESSAGE ***
   20 REM Program to generate
      example machine code
   30 REM G.B.Hill September 1983
   40 REM PROGRAM START
   50 REM OS addresses
   60 oswrch=&FFEE
   70 REM Locate program
      where required. This puts
      it at the top of memory
   80 S%=HIMEM-&100
   90 PROCassemble
  100 CALLexec_address
  110 END
  120
  130 DEFPROCassemble
  140 start_address=S%
  150 message=S%
  160 $message="The code has now
      been saved"+CHR$13+CHR$10
  170 S%=S%+29
  180 FOR opt=0 TO 2 STEP 2
  190 P%=S%
  200 [OPT opt
  210 \subroutine to print message
  220
  230 .print_msg     ldx #0
  240                ldy #29
  250 .loop          lda message,X
  260                jsr oswrch
  270                inx
  280                dey
  290                bne loop
  300                rts
  310 \main program
  320 .exec_address jsr print_msg
  330                rts
  340 ]
  350 end_address=P%
  360 NEXT
  370 ENDPROC
```

Program 2. Generates example machine code



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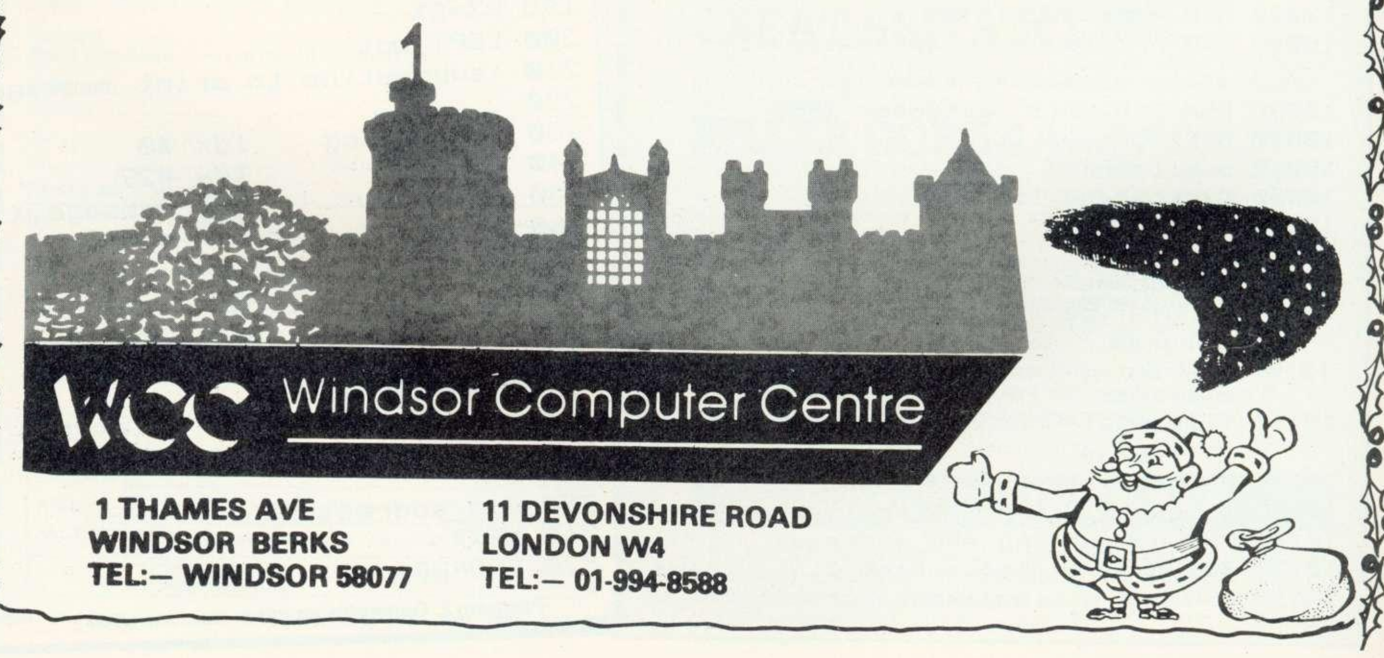
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LISTING THE UNLISTABLE

PUBLISHERS are worried about programs being copied and they go to some lengths to stop programs being listed. However, for the honest among us this is annoying as it is often useful to get inside a program. As I assume all Forum readers are honest, I offer a way to list the unlistable when the mode of protection used is the control code approach.

The idea is to put control codes (usually 21 and 12) into REM statements to turn off the screen. This listing shows a simple way to deal with this, turning all such control codes into 0s, which do no harm.

Save it as a one-liner somewhere, but remember it is only to be used for honest purposes.

Talking about program copying, it's annoying not to be able to make a transfer from tape to disc for some programs without sweating blood. I hoped an enterprising reader would modify my automatic tape-to-disc transfer program (April's Forum, p42) to deal with all cases: machine code and machine code/Basic mixtures. It requires an automatic read of the line produced by *OPT1,2 so that a *SAVE can be performed. Someone's already done it, I'm sure, so let's hear from you.

```
FOR I%=&1900 TO TOP
:IF ?I%=13 THEN I%=I%+3:N.
ELSE IF ?I%<32
TH. ?I%=0:N. ELSE N
```

THE Forum's aim is to exchange ideas, tips and applications for BBC micro and Electron. Chaired by Ian Birnbaum, it enables more experienced programmers to present ideas, which must draw on earlier Forums or be original. In either case, it should be described clearly and fully, with listings supplied. At least £5 will be paid for any tip published. The main judging criteria are originality, and skill in implementing a routine. Your contribution should be typed or printed, with any substantial listings on cassette, but only included to make a point.

£5 OS PLOT CHANGES

HAVING recently changed my operating system from 0.1 to 1.2 (courtesy of Acorn) I am writing to point out a difference between the two which affects the way characters are plotted on the screen.

After the VDU5 command with the 0.1 OS, it is possible to use both the PRINT TAB (x,y) and MOVE (x,y) commands to plot characters anywhere on the screen. With the 1.2 OS however, only the MOVE (x,y) command is supported and for programs written with the 0.1 OS some conversion is required. The line below converts the PRINT TAB (x,y) command into the MOVE (x,y) command,

MOVE (X*scale),1023−(Y*32)

where X is the x position, and Y is the y position. The value of 'scale' for each mode is given in table 1.

Mode	Scale
0, 3	16
1, 4	32
2, 5	64

BEEB FORUM AND ELECTRON

ALTHOUGH this column will continue to be called Beeb Forum, most of what is published here will also be suitable for the Electron. As a general rule, routines will work on the Electron unless:

- discs, the user port, the analogue interface, the RS423 port, etc, are involved;
- the routine is specific to OS 0.1 or Basic 1;
- the routine uses the 6845 CRC;
- the routine involves mode 7;
- the routine depends on simultaneous use of sound channels.

On the other hand, it will be rare indeed for a routine to work on the Electron and not on some version of the BBC micro.

DOUBT CAST ON VERIFY FACILITY

THE lack of a VERIFY facility is one of the few shortcomings on the Beeb and so I was pleased to see your suggestion of using *LOAD""8000 (May, p43). I decided to test this by loading a program, editing in an error and verifying it. *LOAD re-read the original program and gave no error. However, my 'induced' error was still there afterwards. Are you sure this procedure works?

You're quite right, Dr Allwood. My use of the word 'verify' was not exact, as no byte-by-byte check occurs. However, block and checksum errors are detected automatically, so that if the *LOAD goes through OK, it is most unlikely the program has been corrupted.

I'd be interested to receive an efficient tape verification program – does any reader have one? – IB

Ian Birnbaum looks at assembler commands in Basic II on pages 93, 95

£5 FOR DRIPS

DRIPS comes from Mr G (Grizzly?) Beard and is a simple routine to imitate drip noises. If you type it in and RUN, the program will keep on 'dripping' until you press the escape key.

Other readers who have interesting sound – or graphic – effects which aren't too long are invited to send them in. Any routine printed will earn its author at least £5. So if you can do a good Trimphone, let's hear it!

```
 10 REM  ~~~~  DRIPS  ~~~~
 20 REM   G.BEARD  Aug.83
 30 *TV0,1
 40 MODE6
 50 VDU23;8202;0;0;0;
 60 PRINTTAB(6,24)"Press ESC to avoid flooding"
 70 ENVELOPE1,4,45,0,0,6,0,0,1,0,-30,0,0,120
 80 SOUND1,1,0,50
 90 VDU23,224,1,1,3,67,39,23,71,43
100 VDU23,225,0,0,128,196,200,208,194,204
110 PRINTCHR$224+CHR$225
120 GOTO70:REM **** UGH!!-sorry ****
```

£5 OSCLI ADAPTED FOR BASIC II by Steven Entwistle

I READ with interest the article in May's *Acorn User* about the new version of Basic. I was particularly interested in the command OSCLI and, after an hour's work at the keyboard, came up with a machine code program that emulates this function on machines with the older Basic.

My version allows multiple operating system statements to be executed and also the inclusion of Basic variable in the command line. Take these two examples:

```
A$="FX5,2:FX8,4:TAPE:CAT"
CALL &C00,A$
```

and:

```
INPUT "Parallel or Serial printer",B$
IF B$="P" THEN X%=1 ELSE X%=2
A$="FX5,"+STR$(X%)
CALL &C00,A$
```

The program was written on a machine with OS 1.2, although it should work on all operating systems.

■ If all you require are the simplest aspects of OSCLI, you don't need to use this program. For example, $&C00="FX4"+STR$(T): X%=0:Y%=&C :CALL &FFF7 will implement *FX4,T where T has already been defined.

□ Mr Entwistle's routine allows multiple and mixed functions to be performed, if you require these, though these too could be coded in the way that I've just described. – IB

£5 MACHINE CODE SOUND FILTER by Clifford Hoggarth

RECENTLY the need arose to disable the sound on machine code programs such as *Snapper*. The operating system makes sounds via a call to the OSWORD routine. Merely filtering out calls to make sounds does not work, as the timing of the program is corrupted, so the ghosts do not behave as expected. This is because the OS takes time to instruct the sound processor. The machine code patch alleviates this problem by changing any sound to the equivalent of SOUND 0,0,0,0.

■ There are two points to note here. First, take care that the area where you assemble this code is fully protected. It is likely that &C00, for example, will get corrupted in many programs where you want to disable sound, since they will also use user-defined graphics. Second, the program works by altering the X and Y registers, which normally point to the 'correct' parameter block, to point instead to a block which consists of zeros (line 140 onwards). – IB

```
   10 FOR PASS =0 TO 2 STEP 2
   20 P%=&C00
   30 [ OPT PASS
   40 .oscli
   50 LDA &603:CMP#129:Bne error
   60 LDY#0
   70 LDA &601:STA &70:LDA &602
   80 STA &71
   90 LDA(&70),Y:STA &80
  100 LDY#1:LDA(&70),Y:STA&81
  110 LDY#3:LDA(&70),Y:STA&82
  120 DEC &82
  130 LDY#255
  140 .loop1
  150 LDX #255
  160 .loop2
  170 INY:INX
  180 LDA(&80),Y:STA &A00,X
  190 CPY&82:BEQ con1
  200 CMP#58:BNE loop2
  210 DEX
  220 .con1
  230 INX:LDA#13:STA &A00,X
  240 LDX#0:STY&70:LDY#&A
  250 JSR &FFF7
  260 LDY&70:CPY &82:BNE loop1
  270 RTS
  280 .error:BRK:]:?P%=45:P%=P%+1
  290 $P%="Illegal parameters"
  300 P%=P%+LEN($P%)+1
  310 [ OPT PASS:BRK:]
  320 NEXT PASS:END
```

Imitates OSCLI for Basic I

```
   10 REM Only RUN once or incorrect
 vectors will result
   20 CLS
   30 INPUT" Assembly address? "A%
   40 FOR X%=1 TO 2
   50 P%=A%
   60 [
   70 OPT 0
   80 CMP# 7
   90 BNE LABEL
  100 LDX#(A%+&C)AND&FF
  110 LDY#(A%+&C)DIV&FF
  120 .LABEL JSR &FF*?&20D+?&20C
  130 RTS
  140 BRK
  150 BRK
  160 BRK
  170 BRK
  180 BRK
  190 BRK
  200 BRK
  210 BRK
  220 ]
  230 NEXT
  240 ?&20C=A%AND&FF:?&20D=A%DIV&FF
  250 END
```

Disables machine code sound

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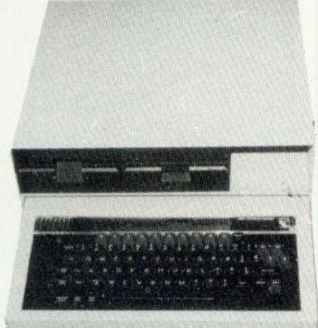
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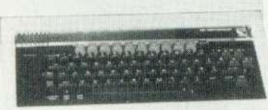
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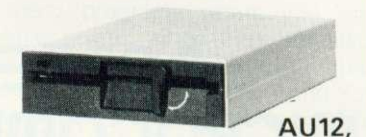
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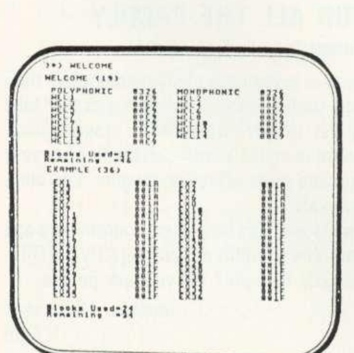
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Foreground	Background	Colour
0	128	black (normal background)
1	129	red
2	130	green
3	131	yellow
4	132	blue
5	133	magenta (blue-red)
6	134	cyan (blue-green)
7	135	white (normal foreground)
8	136	flashing black-white
9	137	flashing red-cyan
10	138	flashing green-magenta
11	139	flashing yellow-blue
12	140	flashing blue-yellow
13	141	flashing magenta-green
14	142	flashing cyan-red
15	143	flashing white-black

SCREEN MODES

Mode	Text	Resolution	Colours	Memory	Value of Himem (Hex) 16k	32k
0	80×32	640×256	2	20k	—	3000
1	40×32	320×256	4	20k	—	3000
2	20×32	160×256	8(+8)	20k	—	3000
3	80×25	—	2	16k	—	4000
4	40×32	320×256	2	10k	1800	5800
5	20×32	160×256	4	10k	1800	5800
6	40×25	—	2	8k	2000	6000
7	40×25	TELETEXT		1k	3000	7000

TELETEXT CODES

Codes for block graphics

160 173 186 231 244
161 174 187 232 245
162 175 188 233 246
163 176 189 234 247
164 177 190 235 248
165 178 191 236 249
166 179 224 237 250
167 180 225 238 251
168 181 226 239 252
169 182 227 240 253
170 183 228 241 254
171 184 229 242 255
172 185 230 243

TELETEXT CODES

Control codes

Code	Effect
129	Red text
130	Green text
131	Yellow text
132	Blue text
133	Magenta text
134	Cyan text
135	White text
136	Flash
137	Steady
138	Nothing
139	Nothing
140	Normal height
141	Double height
142	Nothing
143	Nothing
144	Nothing
145	Red graphics
146	Green graphics
147	Yellow graphics
148	Blue graphics
149	Magenta graphics
150	Cyan graphics
151	White graphics
152	Concealed display
153	Continuous graphics
154	Separated graphics
155	Nothing
156	Black background
157	New background
158	Hold graphics
159	Release graphics

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Compiled by Paul Nash
***Note:* There are separate indexes for Article Subjects, Programs, Reviews, and Competitions; each index entry refers to *issue number (in italics),* then page number(s)**

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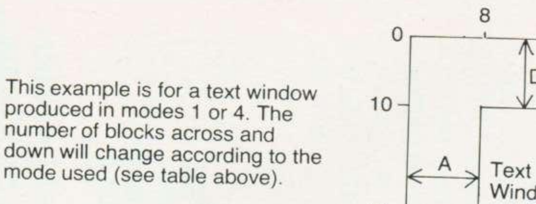
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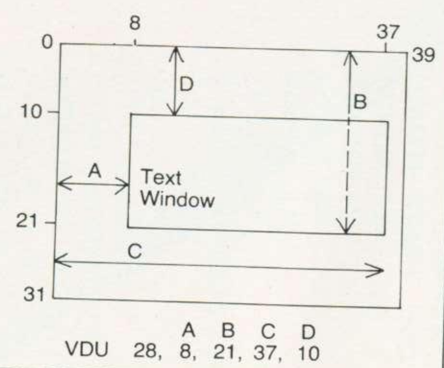
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DEFINING TEXT WINDOWS

This example is for a text window produced in modes 1 or 4. The number of blocks across and down will change according to the mode used (see table above).

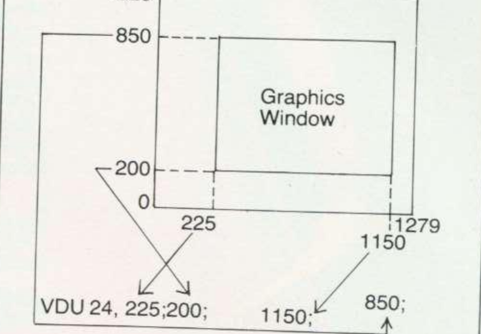





```
10 MODE2
20 VDU24,225;200;1150;850;
30 GCOL0,RND(16)
40 X=RND(1279):Y=RND(1023)
50 PLOT 81,X,Y:MOVEX,Y
60 GOTO 30
```

Example sets up graphics window. Change mode to see effect.

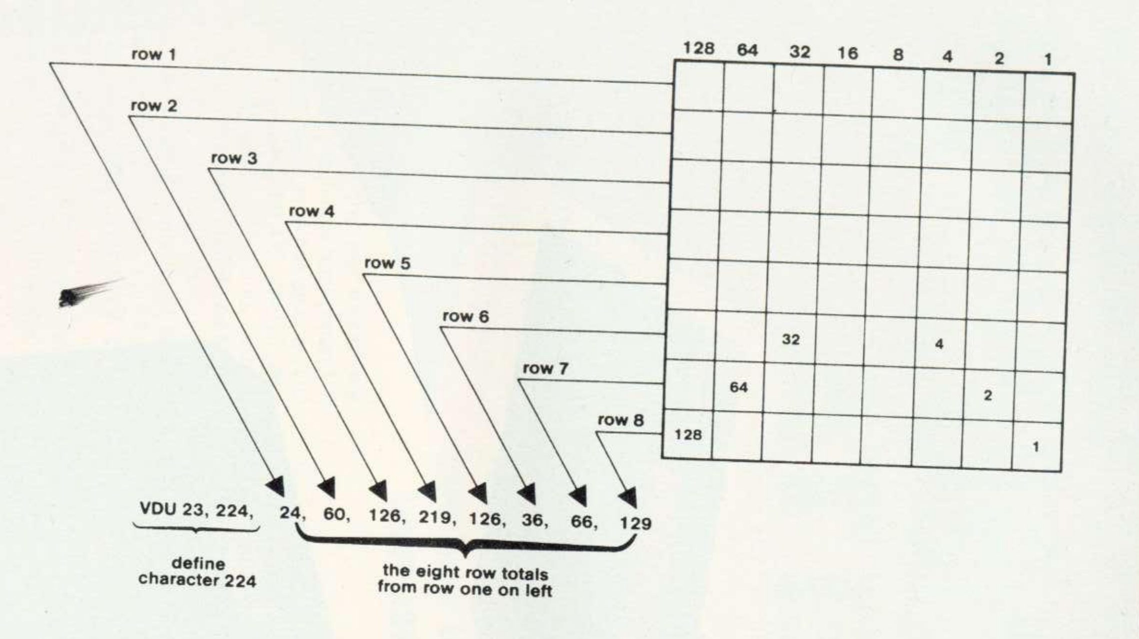
DEFINING GRAPHICS WINDOWS



The values used for graphics windows do not change, because the absolute number of addressable points on the screen is constant, whatever the mode.

Refer to poster in November's Acorn User for other VDU calls.

CHARACTER DEFINITION



PLOT NUMBER SUMMARY

0	Move relative to last point
1	Draw relative to last point in current foreground colour
2	Draw relative to last point in logical inverse colour
3	Draw relative to last point in current background colour
4	Move to absolute position
5	Draw absolute in current foreground colour
6	Draw absolute in logical inverse colour
7	Draw absolute in current background colour
8-15	Last point in line omitted when using 'inverted' plotting
16-23	Using a dotted line
24-31	Using dotted line, but without last point
32-63	Reserved for Graphics Extension ROM
64-71	Single point plotting
72-79	Horizontal line filling
80-87	Plot and fill a triangle
88-95	Horizontal line blanking
96-255	Reserved for future expansions

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A CLOSER LOOK AT EQUS

Basic II in the Electron and Beeb has some sophisticated assembler commands. Ian Birnbaum shows you how to make the best use of them

FOLLOWING on from last month, I will look here at some further uses of the EQUS instruction, illustrating how to implement some sophisticated assembler facilities on the Electron and BBC micro.

Consider the following set of instructions in Basic:

```
MODE0:VDU28,0,31,39,16:
VDU24,0;512;1273;1023;:
VDU29,0;512;:VDU19,1,0;0;:
VDU19,0,3;0;:MOVE0,0:
DRAW400,400
```

This draws a line in the top half of the screen in black on a yellow background. It is, in fact, possible to write this as one VDU statement, replacing MODE, MOVE and DRAW by their VDU equivalents (except that VDU22 will not reset HIMEM as MODE does), and it is from this form that the translation to assembly language is most easily made. I recommend you to write down this single VDU statement before continuing.

To encode this one VDU statement into assembler would require us to type in 90 or so lines of code (there are 31 numbers, but 14 are double bytes). However, there are two ways to simplify this. The first involves getting the assembler to write the 90 or so lines of code for us; the second involves changing our approach so fewer lines are required.

The first approach embodies a technique called 'macro assembly', and listing 1 illustrates it. Lines 50-70 and 90-100 are included only to show how the macro in line 80 can be implemented in the middle of a series of other statements without leaving the assembler: hence no attention should be paid to the content of those lines.

Line 80 illustrates the new use of EQUS. The string returned by FNVDU in line 210 is a null string, so EQUS will put no string into memory! The sole purpose of EQUS here is to implement the macro contained in lines 150-200 without having to leave the assembler. Without this use of EQUS we would probably use a procedure like this:

```
70 STA &71:]
80 PROC VDU(39)
90 [OPT I%
100 LDX &70 etc.
```

Notice that we would have to leave the assembler at 70, returning at 90. Also note that when we return at 90 we must re-execute the OPT statement, otherwise OPT defaults to OPT3.

Anyway, back to listing 1, and lines 150

```
   10OSWRCH=&FFEE
   20DIM START 500
   30FOR I%=0 TO 3 STEP 3:P%=START:RESTORE
   40[OPTI%
   50LDA #0
   60STA &70
   70STA &71
   80EQUS FNVDU(39)
   90.FINISH
  100LDX &70
  110RTS:]NEXTI%
  120CALLSTART:END
  130DATA 22,0,28,0,31,39,16,24,0,0,512,1273,1023,29,0,0,512,19,1,0,
0,0,0,19,0,3,0,0,0,25,4,0,0,0,0,25,5,400,400
  140DEF FNVDU(N):LOCAL D,D$,H,L,J%
  150FOR J%=1 TO N:READ D$:D=EVAL(D$)
  160IF D>255 THEN H=D DIV 256: D= D MOD256 ELSE H=-1
  170IF D<>L THEN [OPTI%:LDA #D:]
  180[OPTI%:JSR OSWRCH:]
  190L=D:IF H=-1 THEN200 ELSE D=H:H=-1:GOTO170
  200NEXTJ%
  210=""
```

Program 1. Macro assembly

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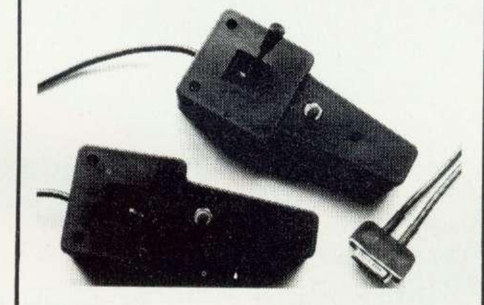
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to 200. Line 150 reads the data from line 130 into the variable D by first reading it into D$ and then using EVAL: this allows us to accommodate hex into the data if we want (eg &10FE could be an item of data). Line 160 checks whether D exceeds 255: if so, it splits it into two bytes, with A the higher and D the lower; otherwise it sets H to −1 as a flag.

Line 170 is an example of what is called 'conditional assembly'. L contains the last byte output and if D is equal to L, we do not need to reload the accumulator, since it will already contain the right value. However, if D is not equal to L the LDA statement will be required. Note again the need for OPTI% in 170 and 180.

In line 190 we set L, the last byte output, to D, and then if H=−1 read the next item of data or if H≠−1 we transfer H to D and use that instead. The parameter N in line 140 contains the number of items in the data statement. Note finally the crucial importance of RESTORE in line 30; there are two passes (I%=0 then 3) and so we need to read the DATA statement twice (in fact, in this example only one pass is strictly necessary, but in most real cases two would be required).

If you run listing 1 with page mode on, you will see all the LDA D : JSR OSWRCH statements being assembled one by one. Thus this approach generates our lines for us automatically, a typical feature of a macro approach.

There is a second approach to implementing the VDU statement – data tables – and to this we now turn. It is shown in listing 2. Again lines 40-70 are arbitrary. Lines 80 to 140 perform a loop to load the accumulator with the next item of data stored at the address TABLE (defined in line 160) and output it with OSWRCH. The value 45 in line 130 is used as a comparison to end since there are 45 bytes (31 numbers but 14 are double bytes).

The table of values is set up with a function called in line 170, again using EQUS with the dummy null string (at 260) to save us having to leave the assembler. Line 240 illustrates the use of EQUB and EQUW to insert the data into memory in a very easy way. Again, this is a simple example of conditional assembly.

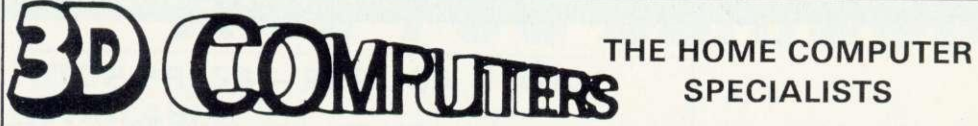
Running listing 2, again with page mode set, shows the essential difference between the macro approach and the table approach. In the latter, the coding to perform the output is written only once but performed many times. In the former, the coding to perform the output is written many times, but each line is only performed once. Thus we can say that the macro approach is an *assembly-time* facility whereas the table approach is a *run-time* facility.

The table approach is generally much more economical on memory than the macro approach, but it is slightly slower in execution time (as the table has to be read, X has to be incremented and compared to the limit, and a branch has to be made). As a rule, then, use tables unless speed is critical, when you should use macros.

Next month, in the final article, I will look at some advanced features of OPT in Basic II, and consider where to assemble machine code in memory. ●

```
10OSWRCH=&FFEE
20DIM START 500
30FOR I%=0 TO 3 STEP 3:P%=START:RESTORE
40[OPTI%
50LDA #0
60STA &70
70STA &71
80LDX #0
90.LOOPVDU
100LDA TABLE,X
110JSR OSWRCH
120INX
130CPX #45
140BNE LOOPVDU
150BEQ OVERTABLE
160.TABLE
170EQUS FNTABLE(39)
180.OVERTABLE
190RTS:]NEXTI%
200CALLSTART:END
210DATA 22,0,28,0,31,39,16,24,0,0,512,1273,1023,29,0,0,
512,19,1,0,0,0,0,19,0,3,0,0,0,25,4,0,0,0,0,25,5,400,400
220DEF FNTABLE(N):LOCAL D,D$,J%
230FOR J%=1 TO N:READ D$:D=EVAL(D$)
240IF D>255 THEN [OPTI%:EQUW D:] ELSE [OPTI%:EQUB D:]
250NEXTJ%
260=""
```

Program 2. Uses data tables



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ERNIE'S OMEN

To Jack Wymer, the BBC micro is more than a computer—it has revolutionised his life

MODERN technology, in all its glorious forms, is ever-increasingly bringing disabled people into the realms of 'normality'.

For me, and my life-long disability from spinal muscular atrophy, it all began with the electrically-powered wheelchair, when for the first time in my 30 years I was learning to cope with the freedom of movement, with all the hazards of stopping distances, turning angles and so on.

Next came the electric typewriter, with its soft touch controls and automatic carriage return, which I was able to operate by holding a short stick in both hands, and pressing one digit at a time.

By this time, I had moved out of institutional care of 20 years' standing, and was living with my almost equally disabled wife, Margaret, in a specially adapted council flat. Electro-mechanical equipment, such as a hoist for lifting us in and out of wheelchairs, was beginning to be taken for granted.

Then came the age of electronics, rapidly developing from the installation of my POSSUM – Patient Operated Selector Mechanism. This meant that, by puffing on a tube or depressing a microswitch, I was able to operate lights, TV, radio, release the electric lock on the front door, and above all, to answer the telephone and dial a call. Recently, I have added a CB radio and a tape-recorder to my range of equipment.

At this stage, life became much fuller and more interesting. Margaret and I founded the Norwich Toy Library for handicapped children, thus taking on all its administration. We then wrote our autobiography (*Another Door Opens*, Souvenir Press). In the International Year of Disabled People 1981, a local newspaper agreed to accept our short weekly feature of special interest to disabled people. My trusty IBM was in constant use almost every day! Surely this must be the climax to what we could achieve?

Then, along came the micro-computer! Our first introduction – to a Sinclair ZX81 – left us stunned. We blamed our confused ignorance on our limited education, and concluded that the world of computers was beyond us. But I felt the word-processor could hold enormous possibilities. I read the advertisements, watched a few TV programmes on computers, visited an exhibition on information technology – and wondered.

Having almost entirely dismissed the subject, together with its prohibitive costs and all, I was one day introduced to Paul Beverley, a regular contributor to *Acorn User*. A subsequent two-hour demonstration of his own BBC micro with Wordwise left me encouraged, though not convinced. But his offer to lend it for a weekend proved to be the confidence-booster I needed!

Having been entrusted with the expert's tools of the trade, I set about taking advantage of every exciting moment, incurring the deep interest of Margaret, and her brother, Gerry, along the way. As my arms tired, Gerry took my place – having already had a little grounding in Basic at school – while Margaret was busily sifting through the instruction manuals. The whole household routine was disrupted. The TV stood cold in the corner, afternoon drinks moved into evening, and tea was postponed as the three of us queued up for our turn.

We shall never forget that first wondrous encounter with the Beeb. But alas, our spirits dropped when the weekend was over, as Paul carried his precious equipment away, we felt as disorientated as coming home from a holiday.

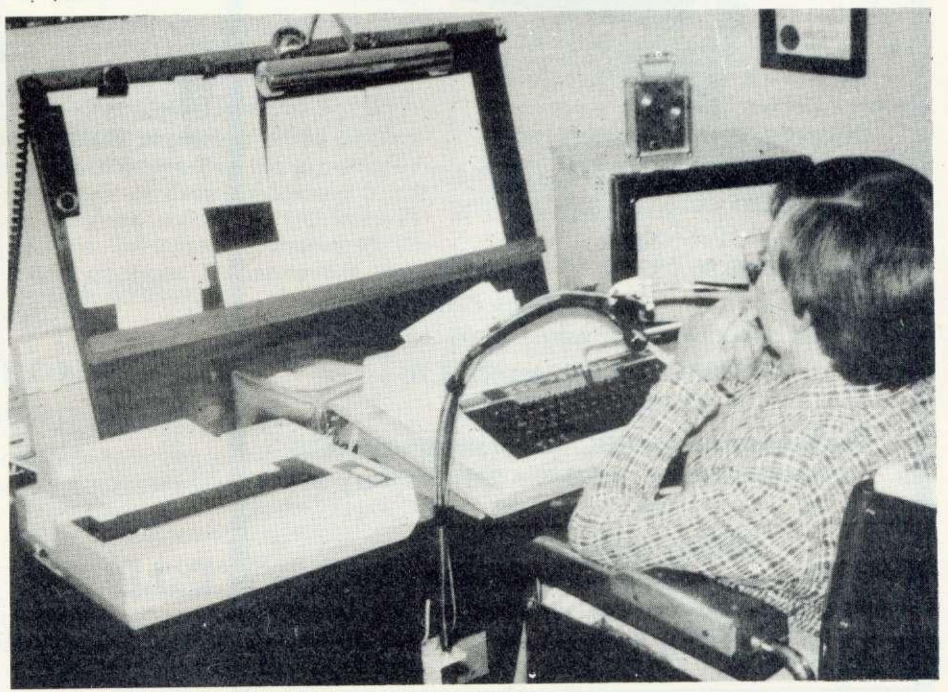
However, we discussed the costs, and racked our brains for some way to raise such a large sum of money. While Paul was enlisting the helpful interest of several firms and individuals, we contacted one or two charitable trusts, and resigned ourselves to providence.

The following week, we were astounded with news of a helping hand from another computer – ERNIE picked us out to win £500 on the Premium Bonds! Who could believe it? But the happy omen confirmed our belief that we should proceed with the venture. And when two of the said trusts agreed to contribute £350 between them, we asked Paul to start ordering the hardware.

Again, good fortune was on our side when I spotted a model A BBC micro advertised in the local classifieds. Never before had anyone been known to part with a beloved Beeb! Paul could scarcely credit this, but was soon on his way to find it in perfect condition. Having it upgraded to a model B was a formality, and the complete deal worked out much cheaper than buying new, thanks in no small measure to Charles Moir of Computer Concepts who donated a Wordwise wordprocessor chip. Our enthusiasm was mounting! And when another friend offered a loan on the balance, it seemed a risk worth taking.

Several weeks later, we found ourselves fully equipped, as first the Epson FX80 printer arrived from North Amber in Surrey; then the 400k Mitsubishi dual disc drive from David Watson of Midwich Computers, and finally, the 14" Cub colour monitor from Chris Moore of Microvitec completed the set-up. We are indebted to these companies for their great kindness in supplying this equipment at generous discounts.

Hitherto, I have been exploring the wonders of Wordwise, and contemplating an efficient filing system for our Toy Library membership. But already, the days of tab and liquid paper, and the endless destruction and rewriting of articles for the sake of improved composition, all seem like a bad dream!



Jack Wymer operates the micro from his wheelchair

CONKERS AND STATISTICS IN THE CLASSROOM

Alistair Ross explains how computers can revolutionise the way children use data

AT FIRST sight data processing might not seem relevant to the primary school. The world of data file creation, information processing and retrieval seems, to many teachers, a remote one. But imaginatively-applied data processing can transform many children's projects. A whole range of skills are developed and exercised – making and testing hypotheses, manipulating numbers and statistics, interpreting and describing, in discussion and written work. Primary school children collect a great deal of information which is ideal for a micro to handle – traffic surveys, opinion polls, weather recordings, nature study observations.

Data processing is the technique of keeping information in a way that allows the users to speedily locate and retrieve the exact piece of data they require. The store of information is called a data file, for example a class register or a dictionary. Both of these data files are normally in written or printed form, arranged in alphabetical order by name. But often we are not searching a dictionary for a word we know: we have a meaning, and seek the correct word, or we want an antonym or synonym, or we want to correct a spelling. Imagine how much easier our task would be if the dictionary could be quickly rewritten so it was listed by meanings rather than by words, or by synonyms in order . . . a computerised data processing system could allow just such flexibility.

However, the real application of data processing in primary schools is not in the use of predetermined data files (such as dictionaries), but of files of information collected by children. Schools are good at getting children to observe the world around them, and to record their experiences and responses. We tend to be less good at getting children to systematically analyse what their results mean, or to hypothesise about the relationships between different observations.

An example of work by my third-year junior class will demonstrate how this can happen – with conkers. One morning before school started, there was a heated argument in the classroom about how to prepare a strong conker. I later widened this into a class discussion about the attributes of strong conkers, in which the experts advanced hypotheses, such as the older the conker the stronger it would be; or that either large or very small conkers were stronger than those in between.

We then devised a class project to measure the strengths and characteristics of conkers. Each was numbered, and its age was recorded (the days elapsed from collection in the park to testing), it was weighed and its volume measured. Then strengths were tested, by dropping a kilogram weight on the conker from various increasing heights until a first crack appeared: the 'strength' was recorded as this final height. We tested over 200 conkers, including some 40 from a year-old hoard.

The conclusions were not immediately obvious: there was a wide scatter of results and no clear correlation between various measurements. We therefore created a data file on the micro to sort out the results. A data file is perhaps best visualised as a large table of results: each vertical column is a **field** (with a **field-name** as its heading), each horizontal row is a **record**, the data about an individual conker. To create a data file we had first to decide how many fields we needed, what each should be called, and how wide each column would need to be. A **file creation program** allowed us to do this, and to add the records of each conker in turn. The program listed the fields for each record, one at a time: the children simply typed in the data as each prompt appeared on the monitor. The children worked in groups of three or four doing this – one typed, the other checked for errors.

Although it might appear a tedious process, it was not found so by most children: it gave them experience of both keyboard and the file structure, and helped them realise that the data held by the micro was *their* information, that *they* had collected and recorded, and not some mysterious ingredient of a silicon chip.

The data file complete, larger groups of half a dozen children took on the task of each testing the various hypotheses we had made. They used a **file interrogation program** to specify particular characteristics that they wanted matched in a particular field or fields. For example, AGE=2 found all the two-day-old conkers, while AGE<4 AND STRENGTH>30 found only those conkers less than four days old with a strength of more than 30 cms/kg. The groups then specified the information they wanted to know about each of these particular conkers, by listing the field-names they were interested in, and requested that the results were printed in a suitable order.

Often long lists of figures needed to be sorted – for example, the strengths of all the conkers were listed in order, and because they were in order they could rapidly be grouped together and converted into a histogram of strengths. Why was a histogram of strengths useful? As one child pertinently observed, before you can talk about strong conkers, you need to say what you mean by 'strong'. The histogram allowed categories to be suggested, argued over, and defined. (A strong conker was defined as one that cracks when the weight is dropped from more than 32.5cms).

Hypotheses were thus tested, then con-

THERE is no database program for school work available for the BBC micro which matches the facilities offered by ILEA's SCAN for Research Machines. Current packages which assume the use of cassettes are fundamentally inadequate and increasingly unrealistic now disc drives are becoming relatively cheap.

An ideal data handling package should include facilities to:

- **maintain large files, ie larger than one disc.**
- **sort and tabulate the output in a variety of ways, both on screen and the printer.**
- **interface with printers commonly used in schools.**
- **add additional routines, eg the graphical routines described above.**
- **store, edit and merge commonly-used enquiries as though they were programs.**
- **provide help at the appropriate level from beginners to expert.**

Given the popularity of the BBC micro in schools and the growing importance of data processing in the curriculum and for school administration, there is a vast market for the right package. Someone out there must have written it – or be writing it now!

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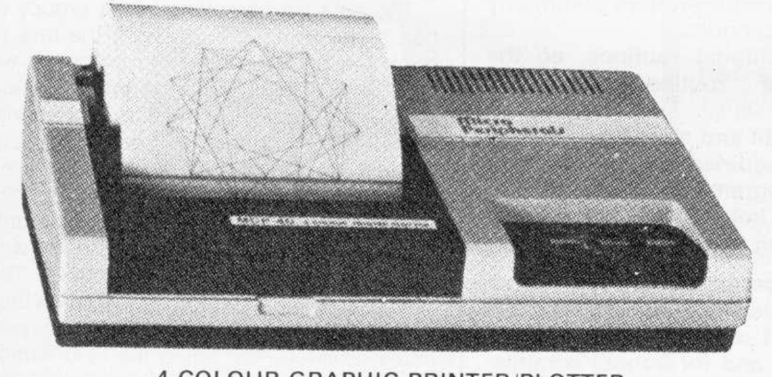
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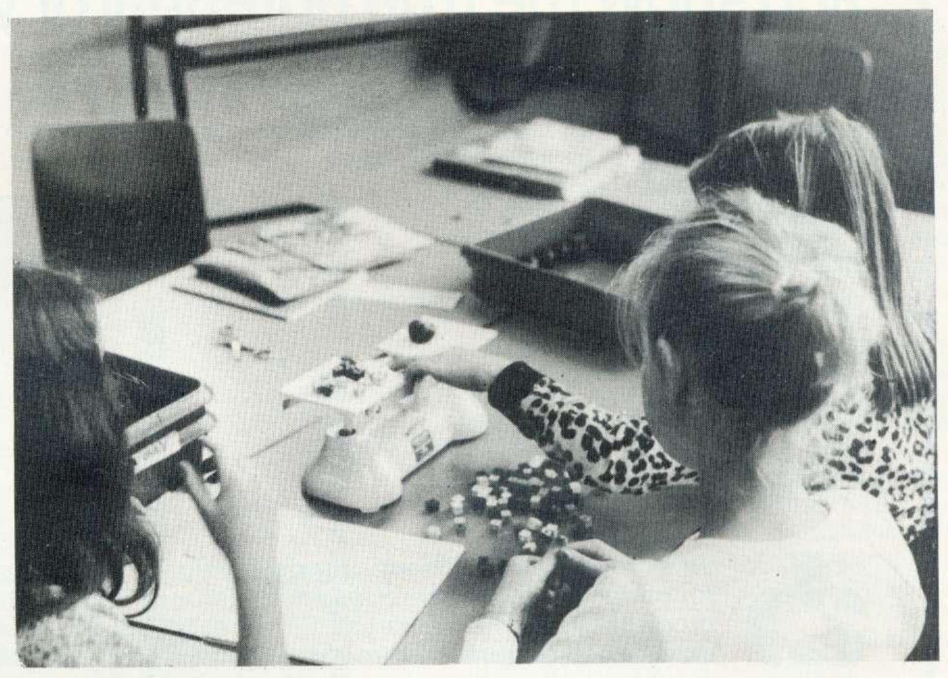


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firmed or abandoned. The class tried various ways of processing the data to demonstrate correlations, both in graphical form and in written descriptions. The advantages the computer brought were not merely accuracy and power. The children now had the ability to test a hunch ('see if really heavy conkers, over 30 grams, are sronger') quickly and relatively painlessly. :f the task had been performed manually, the effort and the time expended in testing a hypothesis that was 'wrong' would have discouraged further exploration.

Most industrial database systems are written specifically for a firm to handle particular kinds of information. In education we need more flexible packages, that enable different kinds of information to be processed in a fairly simple manner – and do not need reprogramming. The conker project above was conducted using MicroLEEP, an ILEA system written for the Research Machines 380Z devised for secondary pupils which can be used with older, primary-aged children without difficulty. MicroLEEP is being replaced in ILEA by SCAN, a faster operating and more powerful system designed to run on disc-operated machines.



Weighing the conkers

The most widely available database package for cassette systems, written specifically for primary schools, is *Factfile* (Cambridge University Press) and is distributed with the *Microprimer* pack from MEP. This is limited as it can only store a small number of records (or a slightly larger number if very few fields are used), and cannot sort items into order. Although this severely restricts users to the simplest of enquiries, it introduces children to data handling, and the introductory file in the package (called Yourfacts) creates a database of information about the children themselves – one of the most popular data files in primary schools.

The six-line program pioneered by Frank Gregory and outlined in *Microprimer*, offers another simple data processing system that has the advantage of showing children clearly and exactly how the program can sift out matching items. It is, however, limited in its potential size of database and in its inability to list data in order.

The more powerful data processing packages that are needed to satisfy children's needs in education are disc-operated. Any school contemplating serious data analysis should therefore consider acquiring a disc drive unit, and also a printer. The ability to take away a hard copy of findings from the micro allows much greater use of the machine than using monitor-displayed results only.

Measuring the volume

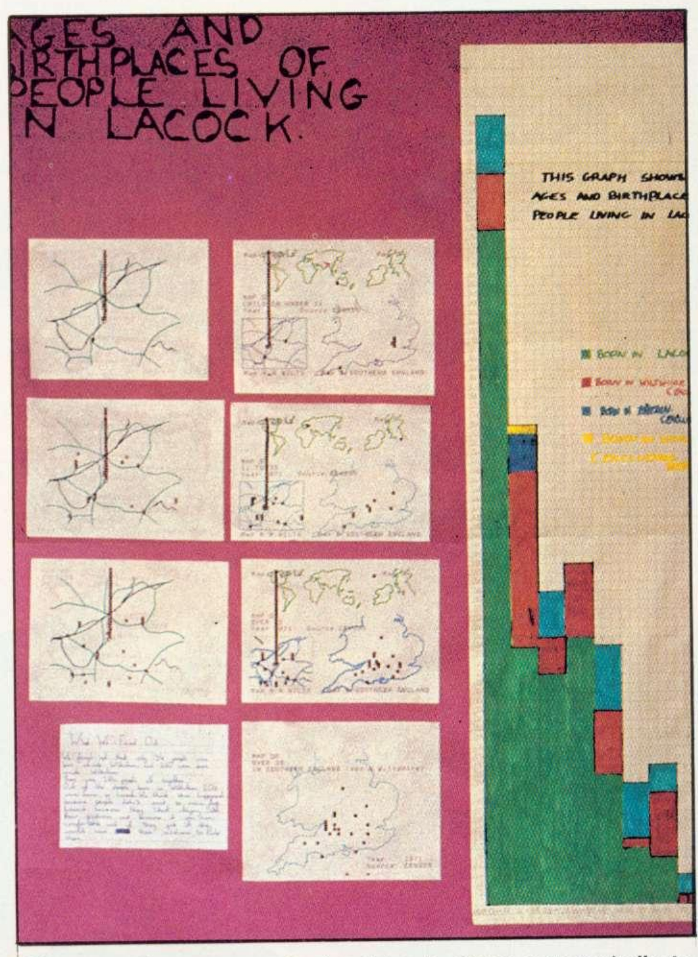


Classroom management of projects like these has not proved difficult. Creating the data file structure, a relatively short task, has usually been the result of class discussion. Entering the records is the task of a few children at a time, with the rest engaged on other work (the record entries made can easily be checked at the end of the session). Interrogation, the main activity, has followed class discussion, in which various groups themselves suggest (or are nominated for) particular investigations. By this stage there are usually many suggestions of possible relationships. There is then an unavoidable initial pressure as each group wants to make its first enquiry, but after this further enquiries tend to even themselves out between groups. Inevitably, the result of each investigation provokes several new possible lines of further enquiry.

Rather than simply list data, there are several programs that translate data lists of findings into graphic displays. These can convey information and relationships far more usefully than lists of numbers or words. They operate by outputting an enquiry result into a subfile, which is then read into the graphics program. For example, data from a single field can be displayed directly as a histogram. Piecharts – notoriously difficult for children to draw – can be created on screen and help children understand proportions. It is also possible to map the location of particular records on the monitor, which can be an extremely effective way of finding patterns of distribution. This is done by including for each record a pair of fields giving co-

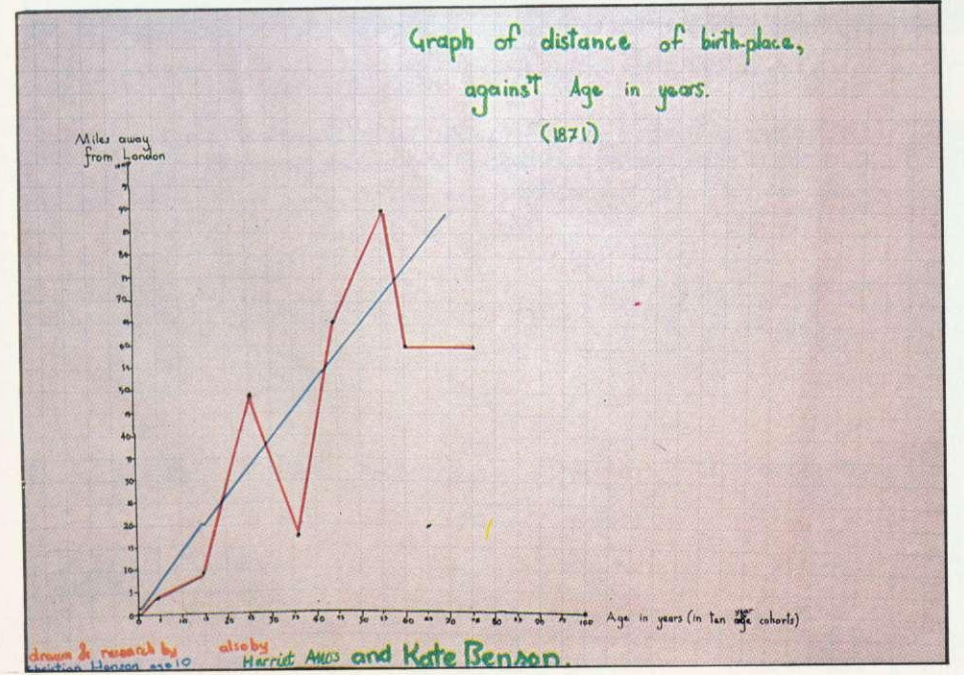
ordinates (east/west, and north/south): when these are output into a subfile they can be read into a program that superimposes each position on to a map.

My ten-year-olds have used some of the graphics facilities with data files they have made based on the 1871 census. The personal details on a census enumerator's form (which are confidential for a hundred years after collection) allow children to reconstruct the lives of individuals and their families. The records contain details of where people lived, their ages, marital status, occupation and birthplace. We have looked both at streets in the local area (Notting Hill in west London) and at the village of Lacock in Wiltshire. The ability to interrogate data files on these areas has allowed the children to work from original historical evidence and to compare the social structure of town and country in mid-Victorian England. Because they have started from real individuals (with whom it is easier to identify than groups or abstract categorisations) they have learned themselves how to make hypotheses about groups, to create their own categories, and to make generalisations.



Histogram shows age on horizontal axis. Green squares indicate people born in Lacock, red squares those born elsewhere in Wiltshire, blue those born elsewhere in the UK, and yellow abroad

Graph of average distance of birthplace from London of ten-year age groups



As they entered the census data, one group thought they noticed that more of the younger people were born locally than the older people. This wasn't an invariable rule – the two people born farthest from Notting Hill were boys of four and six from Canada – but it seemed worth following. But to test the hypothesis that older people were born farther away, and younger people nearer, they realised that they first had to decide what 'old' and 'young' were.

They referred to the work of another group of children who had drawn an age histogram of the population, and then created three approximately equal sized groups – under 20 (young), between 20 and 35 (middle aged) and over 35 (old). Though I personally found the definition of the last category a little depressing, it did accurately reflect the mid-Victorian population!

Three searches were made, one for each group (AGE<20, etc), and the co-ordinates for the birthplace of each person in the group were put on a file and then plotted: the results dramatically confirmed their original hypothesis. One boy went even further: he calculated the distance of each individual's birthplace from London, found the average distance for each 10-year age group, and plotted a graph of distance against age that showed a striking curvilinear relationship. A second group, looking at the same phenomenon in the village of Lacock, found a similar pattern, except that a far greater proportion of the population was born in the village or within four or five miles.

Why? Talking about the possible reasons for this produced several suggestions – most of the class decided that the cities were then offering many opportunities for jobs, and were growing in size. Notting Hill was a new and expanding suburb, attracting workers from the countryside, whose children were naturally born locally. Lacock, on the other hand, was probably in an area that exported labour at this time.

This description is of only one of the dozen lines of enquiry that were started on the census data. All of them showed the considerable potential for genuine enquiry and learning in this area.

Forms of data processing can be adapted to help children work better in many



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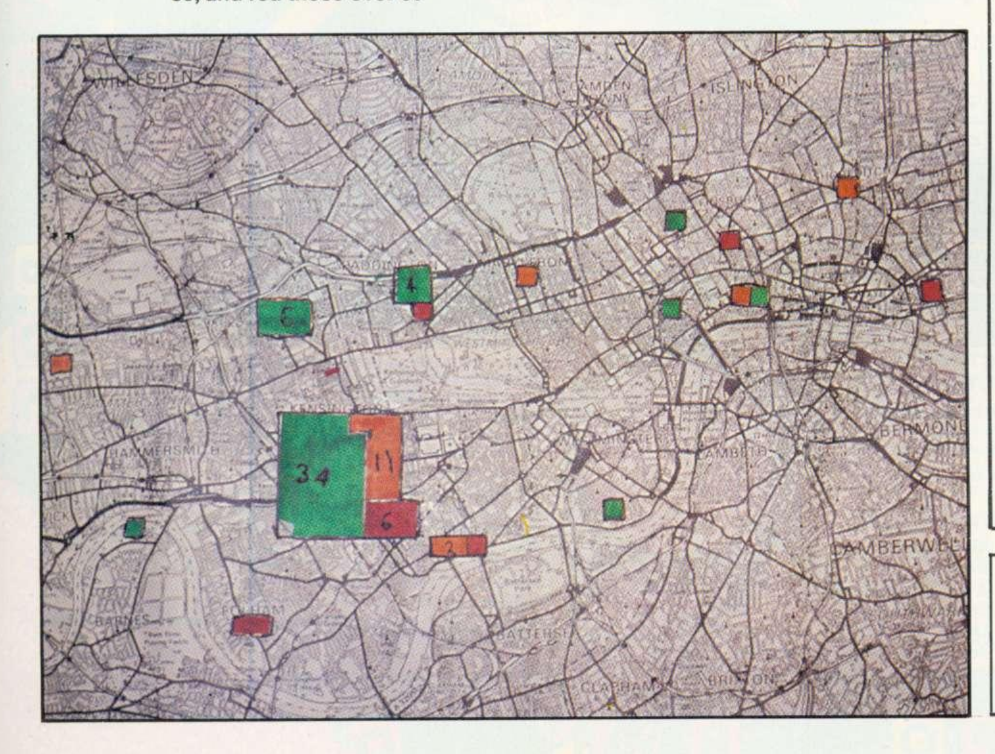
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areas of the primary curriculum. They can help their work by cutting out the routine chores of analysis, giving them the ability to speedily test ideas about information they have gathered. The time then becomes available for high-level discussions about reasons, causes, and further lines of enquiry. The fact that it is their own data, their own enquiries, is vital. Data processing techniques are highly interactive, and when children use them in this way they are stamping their own individuality on the microcomputer, and making it their very own. ●





Where people were born: maps of birthplaces of people living in a Kensington street in 1871. Green shows those under 20, orange 20-35, and red those over 35

POINTS TO REMEMBER

1. **Data processing using a microcomputer enables the teacher to extend the range of activities currently undertaken, particularly if discs are available.**
2. **Specifying all the questions to be asked should precede designing the file and collecting the data.**
3. **The important activity of file design is best done as a class activity to avoid the frustration of pupils entering vast amounts of inappropriate data.**
4. **Pupils must learn that computers process data, and that the translation from their information to the data which the machine can process can involve a loss of information.**
5. **Saving space in memory or on disc will remain an important consideration for the foreseeable future and so the need to code data will be a crucial part of file design.**
6. **The initial use of data processing packages will often be through interrogating existing files. This can avoid data entry problems but can also give pupils ideas about good file design.**
7. **The first files which pupils create should be those which they have a realistic chance of entering reasonably correctly.**
8. **Data should be entered in small portions and frequently saved to avoid the loss of a large number of records through machine failure.**
9. **Printers are essential if pupils are not to waste time copying from the screen.**
10. **Printouts of results should always be accompanied by the enquiry which produced them.**

Alistair Ross teaches in the Fox Primary School in London. Series consultant is Paul McGee


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ATOM & BEEB SHAKING HANDS

Transferring data between different micros, Beeb, Atom, or Pet, is the aim of Vincent Fojut's programs

IF YOU want to communicate with another micro but can't afford Econet, here is a program that can make it possible. It will interest any Atom or BBC owner who wishes to transfer data in a reliable, controlled and, above all, speedy manner. Using the in-built 'handshaking' capabilities of the 6522 VIA (versatile interface adapter) chip, you can write data from one machine to another in little more time than it takes to hit return.

Both Atom and BBC versions of the program are provided, though any 6502 micro, if fitted with a 6522 chip, can be used. Indeed, the two communicating machines need not be of the same type. For example, someone changing from an Atom (or even, say, a Pet) to a BBC micro could easily transfer existing machine-code and data files from one to the other, avoiding the frustration of re-entry.

Handshaking is simply a means by which a computer and peripheral device can inform one another of their readiness to send or receive data. In this case, both the sending and receiving devices are computers (we'll call them the 'transmitter' and 'receiver').

Figure 1 shows interconnections for linking the two machines (it is assumed that both micros are fitted with a VIA). Data is transmitted in parallel, a whole byte at a time, giving extremely fast transfer rates. While most pins link to their counterparts on the other micro (eg, PB0 to PB0, PB7 to PB7), the handshake control ports, CB1 and CB2, are 'cross-coupled' – they connect CB1 on the first micro to CB2 on the second, and CB2 on the first to CB1 on the second. You *must* get this right if the communications program is to work.

Figure 2 gives the pin numbers for the port functions on the BBC and Atom connectors.

A typical handshake sequence might be as follows:

- Transmitter puts data onto data I/O bus (writes to output port).
- Transmitter sends 'data ready' signal to receiver.
- Receiver detects 'data ready' signal and gets data from data I/O bus (reads input port).
- Receiver sends 'data received' (or 'handshake acknowledge') signal to transmitter.
- Transmitter detects 'data received' signal and clears previous 'data ready' signal.

```
100 REM INTER-MICRO CCMMUNICATION (ATOM)
110 REM N.B. 6522 VIA MUST BE FITTED.
120 REM (C) V. FOJUT, 1983.
130 DIM LL15,F1; F.N=0TO15;LLN=-1;N.
140 V=#B800; REM VIA BASE ADDR.
150 S=#80;   REM START ADDR. OF DATA
160 L=#82;   REM LENGTH OF DATA FILE
170 GOS.a;GOS.a; REM ASSEMBLER
180 DO
190   IN."TRANSMIT OR RECEIVE (T/R)"$F
200 U. $F="T" OR $F="R"
210;
220 IF $F="T" GOS.t; REM TRANSMIT
230 IF $F="R" GOS.r; REM RECEIVE
240 END
250;
260tREM TRANSMIT
270 DO
280   IN."START ADDR. OF DATA TO TRANSMIT"'A
290   IN."END ADDR.(+1)"B
300 U. B>A AND B-A<=#FFFF
310 !S=A; !L=B-A
320 P."START RECEIVE PROG. ON 2ND MICRO"
330 P."HIT ANY KEY WHEN DONE"; LI.#FFE3
340 LINK LL0; REM CALL TRANSMIT
350 RETURN
360;
370rREM RECEIVE
380 IN."START ADDR. FOR DATA STORAGE"A
390 !S=A
400 LINK LL3; REM CALL RECEIVE
410 RETURN
420;
430aREM ASSEMBLE MACHINE CODE
440 DIM P(-1); P.$21
450[
460 :LL0  \ TRANSMIT
470  JSR LL6; LDA @#FF; STA V+2
480\
490  LDY @256-2
500 :LL1  \ SEND FILE LENGTH
510  LDX L+2,Y; STX V; JSR LL7
520  INY; BMI LL1
530\
540 :LL2  \ SEND NEXT BYTE
550  LDA (S),Y; STA V; JSR LL7
560  JSR LL8; BNE LL2; RTS
570\
580 :LL3  \ RECEIVE
590  JSR LL6; LDA @0; STA V+2
600\
610  LDY @256-2
620 :LL4  \ GET FILE LENGTH
630  JSR LL7; LDX V; STX V
640  STX L+2,Y; INY; BMI LL4
650\
660 :LL5  \ GET NEXT BYTE
670  JSR LL7
680  LDA V; STA V; STA (S),Y
690  JSR LL8; BNE LL5; RTS
700\
710 :LL6  \ INITIALISE VIA
720  LDA @#7F; STA V+#E
730  LDA @#FF; STA V+#D
740  LDA @#E0; STA V+#C
750  LDA @#80; STA V+#C; RTS
760\
770 :LL7  \ DATA RECEIVED/READY?
780  LDA V+#D; AND @#10
790  BEQ LL7; RTS
800\
810 :LL8  \ INCR. PTR & CHECK IF END
820  INY; BNE LL9; INC S+1
830 :LL9
840  LDA L; BNE LL10; DEC L+1
850 :LL10
860  DEC L; LDA L; ORA L+1; RTS
870]; P.$6; R.
```

Listing 1. Communications program, Atom version

```
TRANSMITTING                                   RECEIVING
COMPUTER'S                                     COMPUTER'S
6522 PORT B.                                   6522 PORT B.

CB1 <---- "data received" handshake line <----  CB2

PB0 -----------------------------------------> PB0
 TO  ------>  data I/O bus (8 lines)  ------>  TO
PB7 -----------------------------------------> PB7

GND (0V) ----------------------------------- GND (0V)

CB2 -------> "data ready" handshake line -----> CB1
```

Figure 1. Interconnections for linking two machines

● Repeat from the first step until all data transferred.

Translating this sequence into compact code is simplified by the peripheral control register (PCR) of the 6522 device. This internal VIA register governs the features of the control lines linked to each port. By storing the appropriate value in the PCR, much of our handshaking requirements are automatically taken care of.

Figure 3 shows the effect of storing #80 in the PCR, as done by the INITIALISE subroutine in listings 1 and 2. (Only bits 4 to 7 are of interest for this application, since they influence the control lines for port B, the user port.)

page 111 ►

BBC pin Nos (20-way 'user port' connector)	Atom pin Nos (64-way Eurocard expansion bus)	Function
2	A12	CB1
4	A11	CB2
6	A10	PB0
8	A9	PB1
10	A8	PB2
12	A7	PB3
14	A6	PB4
16	A5	PB5
18	A4	PB6
20	A3	PB7
(Any odd No from 5 to 19)	A32/B32	GND (0 Volts)

Figure 2. Pin configurations for 6522 VIA Port B lines

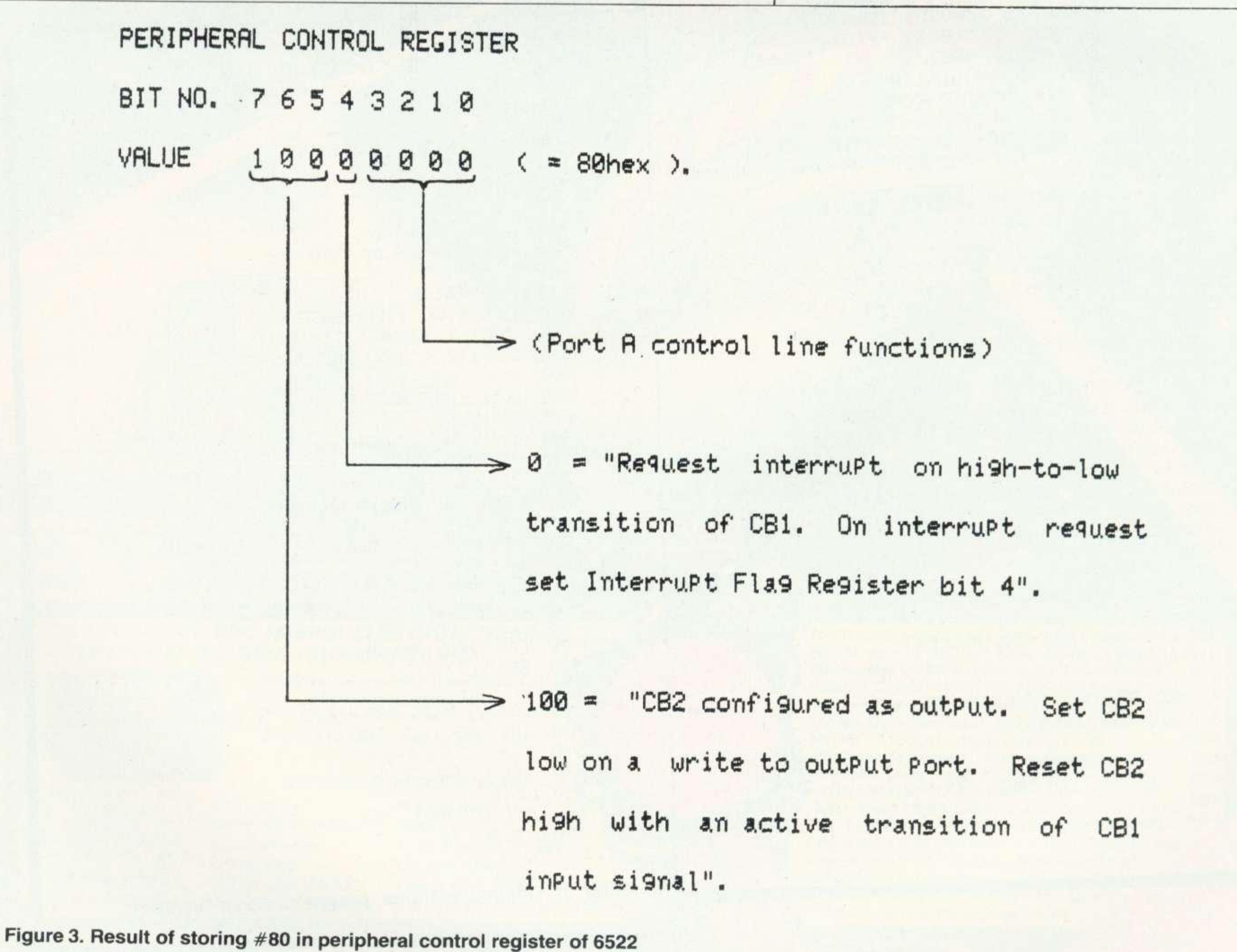
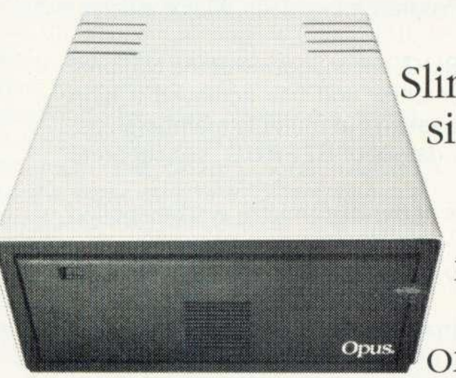


Figure 3. Result of storing #80 in peripheral control register of 6522

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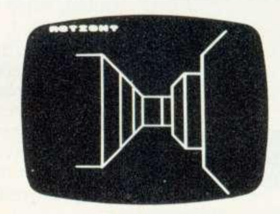
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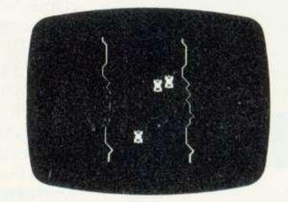
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Let's consider the consequences of this. First CB2 is configured as an output line – CB1 can only ever be an input. Furthermore, whenever a byte is sent to the transmitter's output port, a 'data ready' pulse is automatically sent from CB2 to the receiver's CB1 input. Similarly, by executing a 'dummy write' to its own port, the receiver can inform the transmitter that it has read the data. This also sends a pulse, from the rceiver's CB2 output, back to the CB1 input of the original machine.

The value stored in the PCR also causes any 'active transaction' on CB1 to set bit 4 of the VIA's interrupt flag register (IFR). Reading the IFR provides both micros, sending or receiving, with a simple means of checking the other machine's status (CB1-CHECK subroutine in the listings).

The Atom and Beeb program listings follow the same structure. Differences are mostly due to variations in Basic dialect and the need to use different VIA addresses in machine code. For convenience, however, all future references will be to the BBC listing, since the parallels in the Atom version should be obvious.

In use, the program largely mimics the cassette filing system. PROCtransmit prompts you to enter the start and end address (+1) of the data block to be sent (just as with a machine code *SAVE). You are then reminded to start the 'receive' program on the other micro, just as the cassette system advises you to start recording before saving.

In PROCreceive, only the start address for storage is entered (this will often be different from the original start address, especially if different models of micro are being used). Note, incidentally, that hex values are not assumed, so be sure to precede the addresses by '#' or '&' if appropriate.

PROCtransmit also calculates the length of the data file and sends this information as the first two bytes in any data transfer (see the assembler code around labels SENDLGTH & RECLGTH). This 'length parameter' gives both processors a simple means of detecting when the data transfer is completed (performed by the ENDCHECK subroutine). On hitting return, you may be forgiven for thinking that the program has not executed, when you see how quickly the cursor reappears.

Though useful in its own right, the existing program also serves as a foundation for more ambitious extensions. For example, data transfer could be interrupt-driven, so programs could execute 'concurrently'. Alternatively, a second micro might be used as a sophisticated spooling device, freeing the main CPU for other tasks. Certain values of data bytes could be interpreted as control characters or 'command tokens', enabling several different programs to be selected and run on a subordinate micro, under the supervision of another 'remote' machine. ●

```
100 REM INTER-MICRO COMMUNICATION (BBC)
110 REM USES CONTROL LINES ON 6522 VIA,
120 REM FOR FAST DATA TRANSFER, WITH
130 REM HANDSHAKING.
140 REM (C) V. FOJUT, 1983.
150 OPB =&FE60: REM OUTPUT PORT B
160 DDRB=&FE62: REM DATA DIRECTION REG. B
170 PCR =&FE6C: REM PERIPHERAL CONTROL REG.
180 INFR=&FE6D: REM INTERRUPT FLAG REG.
190 INER=&FE6E: REM INTERRUPT ENABLE REG.
200 START=&80:  REM POINTER TO DATA
210 LGTH=&82:   REM LENGTH OF DATA FILE
220 :
230 PROCassemble
240 :
250 REPEAT
260   INPUT "TRANSMIT OR RECEIVE (T/R)", FUNCTION$
270   UNTIL FUNCTION$ = "T" OR FUNCTION$ = "R"
280 :
290 IF FUNCTION$ = "T" PROCtransmit ELSE PROCreceive
300 END
310 :
320 DEFPROCtransmit
330 REPEAT
340   INPUT "START ADDR. OF DATA TO TRANSMIT",FIRST$
350   FIRST=EVAL(FIRST$)
360   INPUT "END ADDR.(+1)",LAST$
370   LAST=EVAL(LAST$)
380   UNTIL LAST>FIRST AND LAST-FIRST<=&FFFF
390 !START=FIRST: !LGTH=LAST-FIRST
400 PRINT"START RECEIVE PROGRAM ON 2nd MICRO"
410 PRINT"HIT ANY KEY WHEN DONE": X=GET
420 CALL TRANSMIT
430 ENDPROC
440 :
450 DEFPROCreceive
460 INPUT "START ADDR. FOR DATA STORAGE",FIRST$
470 !START=EVAL(FIRST$)
480 CALL RECEIVE
490 ENDPROC
500 :
510 DEFPROCassemble
520 DIM CODE &80
530 FOR J=0 TO 2 STEP 2
540   P%=CODE
550   [ OPT J
560   .TRANSMIT
570   JSR INITIALISE         \ SET UP VIA.
580   LDA #&FF: STA DDRB     \ PORT B = OUTPUTS.
590   \  SEND FILE LENGTH
```

Listing 2. Communications program, BBC version *continued on page 113*

continued from page 111

```
600   LDY #256-2
610   .SENDLGTH
620   LDX LGTH+2,Y: STX OPB  \ WRITE TO PORTB.
630   JSR CB1_CHECK          \ WAIT TILL RECEIPT
640                          \ ACKNOWLEDGED.
650   INY: BMI SENDLGTH
660   \  (Y=0 AT END OF LOOP)
670   .SENDBYTE
680   LDA (START),Y: STA OPB \ WRITE DATA TO PORT.
690   JSR CB1_CHECK          \ BYTE RECEIVED?
700   JSR END_CHECK          \ END OF DATA?
710   BNE SENDBYTE: RTS      \ CONTINUE IF NOT.
720   \
730   .RECEIVE
740   JSR INITIALISE
750   LDA #0: STA DDRB       \ PORT B = INPUTS
760   \   GET FILE LENGTH
770   LDY #256-2
780   .RECLGTH
790   JSR CB1_CHECK     \ WAIT TILL DATA READY.
800   LDX OPB: STX OPB \ GET DATA; PULSE CB2 LOW.
810                    \ ( = "DATA RECEIVED").
820   STX LGTH+2,Y
830   INY: BMI RECLGTH
860   \  (Y=0 AT END OF LOOP)
870   .RECBYTE
880   JSR CB1_CHECK     \ DATA READY?
890   LDA OPB: STA OPB \ GET DATA; SEND "DATA REC'D".
900   STA (START),Y
910   JSR END_CHECK      \ END OF DATA BLOCK?
920   BNE RECBYTE: RTS \ CONTINUE IF NOT.
930   \   COMMON SUBROUTINES.
940   .INITIALISE          \ SET UP VIA.
950   LDA #&7F: STA INER \ DISABLE VIA INTERRUPTS.
960   LDA #&FF: STA INFR \ CLEAR INTERRUPT FLAGS.
970   LDA #&E0: STA PCR  \ ENSURE CB2 HIGH.
980   LDA #&80: STA PCR  \ SET HANDSHAKE PROTOCOL.
990   RTS
1000  \
1010  \ WAIT TILL BIT 4 OF INT. FLAG REG.
1020  \ IS SET, BY HI-TO-LO PULSE ON CB1
1030  \ = "DATA RECEIVED" DURING 'TRANSMIT' PROC;
1040  \ = "DATA READY" DURING 'RECEIVE' PROC.
1050  .CB1_CHECK
1060  LDA INFR: AND #&10 \ BIT 4 SET?
1070  BEQ CB1_CHECK: RTS
1080  \
1090  \ INCREMENT DATA POINTER, DECREMENT LENGTH,
1100  \ & CHECK IF LENGTH = 0 (= END OF FILE).
1110  .END_CHECK
1120  INY: BNE SKIP: INC START+1
1130  .SKIP
1140  LDA LGTH: BNE SKIP1: DEC LGTH+1
1150  .SKIP1
1160  DEC LGTH: LDA LGTH: ORA LGTH+1: RTS
1170  ]: NEXT J
1180 ENDPROC
```


This simple utility for the Atom will delete blocks of lines from memory

BLOCK DEMOLITION

TO DELETE a set of lines from a program, each line number must be typed at the keyboard and followed by RETURN. This is fine for one or two lines, but deleting a whole block is time-consuming, to say the least.

Atomdel is a simple utility program which removes the tedium of deleting large blocks of lines individually.

To set the utility up, reset the text space pointer to an area of memory that is free from use. On an expanded Atom this would normally be:

```
?18=#82,
NEW
```

unless your program uses high resolution graphics, when it would need to be located elsewhere.

Enter the listing as shown. It will occupy about 0.5k of memory, less if you abbreviate the text and remove non-significant spaces. Return to the main text area and enter the following program line:

```
9999a Z=?18;?18=#82; GOTO5
```

The line number is not important, but should be chosen so it will not interfere with your program. Use of the label is optional: if used it should not be used again in the main program.

Enter your own program as usual. When you require to delete a set of lines, type:

```
G.a or G.9999
```

and reply to the prompts. All line numbers inclusive of those specified will be removed from your own program, before the utility returns control to the calling text space.

Now, for an explanation of how Atomdel works. After entering the command G.a, the value of the current text space is saved in the variable Z. The text space pointer is then reset to the area of memory that contains Atomdel, which is set RUNning by GOTO5.

The start and end line numbers are requested (line 10) and checked to ensure they are in order (line 15). The DO . . . UNTIL loop of lines 20 to 30 calls a subroutine which increments the memory counter variable A, through memory until a carriage return (ASCII 13) is encountered. This marks the end of a line of text. The next byte (line 210) is tested to see if it is equal to 255 (FF hex). This value is used by the Atom Interpreter to mark the end of a program and its position is that used by TOP. If TOP has not been reached, the next two bytes will contain the next line number, stored high-byte first. This value is converted to decimal (line 215) and saved in the variable X. After RETURNing the loop is continued until X is equal to B, the start line number. The address of this line is saved in L (line 35).

This is repeated in lines 40 to 50, to find the position of C, the end line number. Lines 55 to 60 increment the memory counter until it reaches the end of line C, and this address is saved in M.

The DO . . . UNTIL loop of lines 75 to 85 moves the program above line C down through memory over the now-deleted program lines, until TOP is encountered. This position is then reset in line 90, while line 95 seeds locations 13 and 14, which hold the address of TOP, with this new value contained in the low order bytes of the variable A.

Line 100 restores the text space pointer, and the revised program can now be listed. ●

```
  1 REM ******************
  2 REM **   ATOMDEL     **
  3 REM ******************
  4
  5 A=Z*256-1
 10 INPUT "START" B, "END " C
 15 IF C<B GOTO 300
 20 DO
 25   GOSUB 200
 30 UNTIL X=B
 35 L=A
 40 DO
 45   GOSUB 200
 50 UNTIL X=C
 55 DO  A=A+1
 60 UNTIL  ?A=13
 65 M=A
 70 N=-1
 75 DO N=N+1
 80    L?N=M?N
 85 UNTIL M?N=255
 90 L?(N+1)=255
 95 ?13=?#322 ; ?14=?#33D
100 ?18=Z
105 END
110
200 DO A=A+1
205 UNTIL ?A=13
210 IF A?1=255 GOTO  300
215 X=A?1*256+A?2
220 RETURN
225
300 PRINT $7' "ERROR"
305 GOTO 100
```

Atomdel for deleting blocks of lines

EASY GRAPHICS

USING the 'word indirection operator', thankfully abbreviated to a pling (!), it is possible to store shapes in programs ready for displaying on the screen. For example, figure 1 shows how a spaceship of sorts could be designed using an 8 × 8 matrix grid. The column of numbers refers directly to the hexadecimal representation of the bit-pattern for each byte. Thus the bottom byte is 7Ehex, which is 01111110 in binary. Using program 1, this shape could be displayed on the mode 4 screen.

Hand-drawn construction of characters and calculation of the word vector used to store them can be tedious and time-consuming so Grafsign (program 2) was developed. Characters can be designed at the keyboard and displayed in any screen mode. Once complete, the relevant word vector containing the bit-pattern information can be displayed.

Memory requirements are minimal. The program occupies less than 1k but a minimum of 1k of memory in the upper text space is required. By condensing the program it can be reduced to less than 0.5k.

On RUNning, the screen clears to the normal teletype mode and displays an 8 × 8 matrix, each row representing a byte of screen memory. A question mark is displayed in the first empty cell. The program then loops through lines 55-70, waiting for either the SHIFT or REPT key to be pressed. Pressing SHIFT sets that particular bit and places a '1' in the byte vector Y, and REPT clears that bit and places a '0' in the byte vector Y. At the completion of each row (byte) the bit-pattern is checked and its byte value stored in the word vector Z. This process is repeated until the block of eight bytes is complete.

The word vector value is then displayed and this should be noted for future reference if required. The subroutine at F802hex is used to print the accumulator's contents (passing from the Basic variable A) as a two-digit hexadecimal number. This is important as all zeroes are significant and could be 'lost' if Basic's PRINT statement were used instead. The character is then displayed in the desired graphics mode for examination.

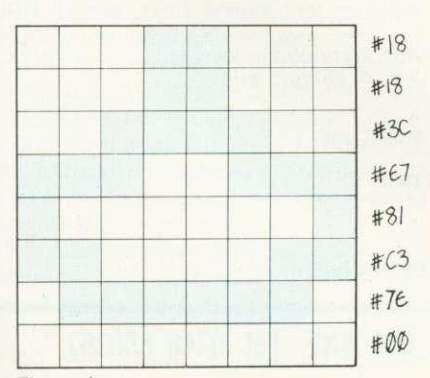


Figure 1.

```
10 DIM Z7
20 !Z=#E73C1818
30 Z!4=#007EC3
40 S=#8005 : L=64
50 FOR N=0 TO 7
60   S?L=Z?N
70   L=L+32
80 NEXT N
90 END
```

Program 1.

```
   1  REM *******************
   2  REM ***    GRAFSIGN    ***
   3  REM *******************
   4
   5   !#81=#85FFE620 ; !#85=#6080
  10  DIM Y7,Z7
  15  F=0 ; M=0 ; @=0 ; E=0 ; H=128 ; L=64
  20  B=#8020 ; C=B ; S=#8005 ; G=#B001
  25  PRINT $12" GRAFSIGN "''
  30  PRINT"  12345678"''
  35  PRINT 1'2'3'4'5'6'7'8''
  40  DO
  45   DO
  50    ?C=CH"?"
 55d    IF ?G<128 GOTO a
  60    IF G?1&64=0 GOTO b
  65    GOTO d
 75c    FOR N=0 TO 750 ; NEXT
  80   UNTIL C=B+8
  85   FOR N=0 TO 7
  90    IF Y?N=1 E=E+H
  95    H=H/2
 100   NEXT
 105   Z?F=E ; F=F+1
 110   B=B+32 ; C=B ; M=0 ; E=0 ; H=128
 115  UNTIL B=#8182
 120  PRINT "VECTOR IS: "'" !Z=#"
 125  U=3 ; V=0 ; GOSUB h
 130  PRINT"  Z!4=#"
 135  U=8 ; V=4 ; GOSUB h
140e  PRINT''"ENTER GRAPHICS MODE"
 145  LINK #81
 150  Q=(?#80-48)
 155  IF Q>4 PRINT $13 ; GOTO e
 160  CLEAR Q
 165  FOR N=0 TO 7
 170   S?L=Z?N
 175   L=L+32
 180  NEXT
 185  END
 190
 195  REM ** SHIFT KEY **
200a  ?C=127 ; Y?M=1 ; GOTO k
 240
 245  REM ** REPT  KEY **
250b  ?C=32 ; Y?M=0
260k  M=M+1 ; C=C+1
 265  PRINT $7 ; GOTO c
 290
 295  REM ** PRINT WORD VECTOR **
300h  FOR N=U TO V STEP -1
 305   A=Z?N
 310   LINK #F802
 315  NEXT
 320  RETURN
```

Program 2. Grafsign displays an 8 × 8 matrix

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Bruce Smith points the way to investigating the Atom's ROM

DISASSEMBLER

ONE of the features that sets Acorn computers apart from their rivals is the incorporation of splendid two-pass assemblers. The Atom was the first home computer to include a full two-pass assembler which could be used within Basic programs. This opened up many possibilities, including the use of macros and conditional assembly previously available only on much larger machines.

The inclusion of the assembler in the Atom encouraged me to delve into the so-called mysteries of machine code and it wasn't long before I was writing assembler in preference to Basic. However, it soon became apparent that many of my own machine code subroutines were present in the Atom's ROMs and if I could locate them I would save time and memory. I therefore set about writing a disassembler to investigate the ROMs.

The purpose of a disassembler is to convert the hexadecimal numbers of a machine code program into a more readable and friendly mnemonic form, so you need a complete list of the mnemonics and an algorithm which will transform the PEEKed opcode into the correct mnemonic statement. As several modes of addressing are available on the 6502 you must also include a coding system to distinguish between them, thus allowing the correct formatting to be printed. Program 1 details the codes associated with each addressing mode.

As you can see from the listing, the mnemonic text is stored at the end of the program from line 370 onwards. The way this is entered is crucial so read it carefully. The first line of text is preceded by a label 't' (inverted T on the screen), which is used as a pointer to the mnemonics. Care must be taken to ensure that only a *single* space is entered throughout between the line number and start of the mnemonic text, except in line 370, where a 't' replaces the space. The end-of-line carriage return should also follow on immediately at the end of the line of text, so make sure no spaces are entered before hitting RETURN. These points ensure that no offset occurs when the main program accesses the table to locate the correct mnemonic.

When run, the variable Q is incremented through the current text space until it encounters the label 't' (ASCII code 116). This address is saved in the variables Q and P, the latter being used to reset Q (lines 40-55).

Two addresses are then requested. The first is the start address from which disassembly will take place, and this may be entered in decimal or hexadecimal preceded with a hash '#'. The second and

```
  1  REM ****************************
  2  REM **** atom disassembler ****
  3  REM ****************************
  4
  5  DIM A3,B12,C28
 10  $B="disassembler"
 15  $C="addr  opcode     mne operand"
 20  PRINT $12$B''
 25  @=4;E=#B001;F=#B002;G=#B000;
     H=#80;J=#40
 30  Q=?18*256
 35  DO Q=Q+1;UNTIL ?Q=13 A.Q?3=116;P=Q
 40e IN."START ADDR."U,"END ADDR. "V
 45  P.$C'
 50  IF V=0 N=U;DO GOTO a
 55  FOR N=U TO V
 60a K=?N;L=N?1;R=N?2
 75  S=((K/10)*44)+((K%/10)*4+4);Q=Q+S
 80  FOR M=0 TO 3;A?M=Q?M;NEXT
 85  Q=P;T=A?3;A?3=13
 90  PRINT"   "
 95  P."#"&N,&K;GOSUB(200+T);@=4
100  IF ?E&H=0 DO PRINT"waiting"$13;
     LINK#FE22; WAIT;UNTIL ?F&J=0
105  ?G=9; IF ?E&1=0 GOSUB b
110  ?G=0; IF ?E&J=0 N=N-81;
     PRINT$12$C';GOSUB b
115  IF V=0 N=N+1; UNTIL K=0 OR K=96
     OR K=76; GOTO c
120  NEXT
125  PRINT$3
150  END
154  REM **** delay routine ****
155b FOR M=0 TO 500;NEXT;RETURN
240 REM *********************************
241 REM *** addressing mode details ***
242 REM * do NOT change lines numbers *
243 REM *********************************
244
248 PRINT"              "$A;R.
249 GOS.f;@=1;P.&L;GOTO g
250 GOS.f;@=1;P.&L",X";GOTO g
251 GOS.f;@=1;P.&L",Y";GOTO g
252 GOS.h;P."(#";@=1;P.&L",X";GOTO g
253 GOS.h;P."(#";@=1;P.&L",Y";GOTO g
254 GOS.j;P.';N=N+2;RETURN
255 GOS.j;P.",X"';N=N+2;RETURN
256 GOS.j;P.",Y"';N=N+2;RETURN
257 GOS.y;GOS.f;P.&X;GOTO g
264 GOS.k;P." @";@=1;P.L;GOTO g
265 gos.k;P." A"';RETURN
```

continued on page 121

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end address may be entered as above or simply as a zero. In the first instance the disassembler will run until the end address is reached. Entering a zero will cause memory to be disassembled until a RTS, JMP or BRK opcode is encountered. This is controlled by the DO . . . UNTIL loop of lines 70 and 130.

The expression in line 85 calculates the displacement from the label 't' of the required mnemonic, the opcode for which is held in the variable K. This displacement is added to Q to give the start address of the mnemonic within the program, which is subsequently read into $A. The addressing code is saved in T for future use and the end of $A is reset with a carriage return (ASCII 13).

Three types of listing control are provided. Line 100 tests for the SHIFT key, which if pressed halts the listing until the REPT key is hit. During suspension of the listing the string 'waiting' is displaced on the screen. This uses a subroutine in the Atom ROM at FE22hex to erase the line specified in locations DEhex and DFhex, the cursor position pointers.

Pressing the space bar (line 105) creates a short delay, effectively slowing the listing down. Finally, line 110 causes the disassembly to jump back 81 bytes if the CNTR key is pressed, allowing areas of memory to be re-examined.

Print formatting is taken care of by lines

continued from page 119

```
266
267 REM *** subroutines ***
268
270f P.&L"        "$A" #";RETURN
275g N=N+1;PRINT';RETURN
280h PRINT &L"        "$A;RETURN
285j P.&L,&R"  "$A"
#";@=1;P.&R;GOS.z;P.&L;RETURN
290k P.&L"        "$A;RETURN
300z IF L<16 PRINT"0"
305  IF R=0 PRINT"0"
310  RETURN
315y IF L<128 X=(N+2)+L;RETURN
320  IF L>128 X=(N+1)-(255-L);RETURN
330
340 REM ********************************
341 REM ******   mnemonic data   ********
342 REM *** enter exactly as shown ****
343 REM * with ONE space ONLY between *
344 REM *line number and start of text*
345 REM * and a CR at very end of text*
346 REM ***   i.e. no extra spaces!  ***
347 REM ********************************
350 REM
```

continued on page 122

Figure 1. Mnemonic codes

Code	Addressing	Format	Description
0	Implied	BRK	
1	Zero page	LDA # 90	The single byte following the opcode is the address of data to be acted upon, in zero page.
2	Zero page, X	LDA # 90, X	The byte following the opcode, when added to the specified register is the address, in zero page, of the data to be acted upon.
3	Zero page, Y	LDX # 90, Y	
4	(Indirect, X)	LDA(# 90, X)	**Pre-indexed:** The byte following the opcode, when added to the X register is an address, in zero page. The two bytes at this address are used as the effective address for the instruction.
5	(Indirect), Y	LDA(# 90), Y	**Post-indexed:** The byte following the opcode is a zero page address. The two bytes at this address when added to the Y register are used as the effective address for the instruction.
6	Absolute	JSR #FFF4	The two bytes following the opcode are the effective address.
7	Absolute, X	LDA # 2900, X	The two bytes following the opcode, when added to the specified register is the address of the data which is to be acted upon.
8	Absolute, Y	LDX # 2900, Y	
9	Relative	BNE # 2805	Branch forwards or backwards to specified address.
@	Immediate	LDA @ 7	Byte following instruction is the actual data to be acted upon.
A	Accumulator	ASL A	The accumulator contains the data to be acted upon.

248-290 and the appropriate routines are called by the calculated GOSUB of line 95.

The mnemonic text contains a number of illegal mnemonics represented by ERR (short for error). The reason for this is twofold. First, legal opcodes do not run consecutively, so there are gaps in the text which need to be filled if the variable S is to be evaluated correctly. Second, machine code programs, particularly the Atom interpreter, often incorporate information in the form of reference tables. When the disassembler reaches these areas 'ERR' mnemonics will usually be generated – although not always as some bytes will coincide with legal opcodes, generating proper mnemonics incorrectly. However, these erroneous listings will normally be obvious.

Examples of these look-up tables within the ROM are 'ACORN ATOM' displayed on reset and located in memory from FF6Fhex, and the binary-to-decimal conversion table used by Basic from C608hex to C621hex.

In its present form the disassembler occupies about 2.5k of memory. This can be reduced to less than 2k by removing all non-essential spaces and REM statements. The floating point ROM is not required and the utility may be entered in either the upper or lower text spaces.

$A	String to hold mnemonic	L, R	Operand(S)
$B, $C	Headings	M, N	Loop counters
E	Keyboard column – port A	P, Q	Text pointers
F	Rept key – port C	S	Mnemonic pointer
G	Keyboard row – port B	T	Temporary for mnemonic code
H	Masking variable/Zero page memory	U, V	Start/End addresses
J	Masking variable	X	Branch address
K	Opcode		

Figure 2. Variables

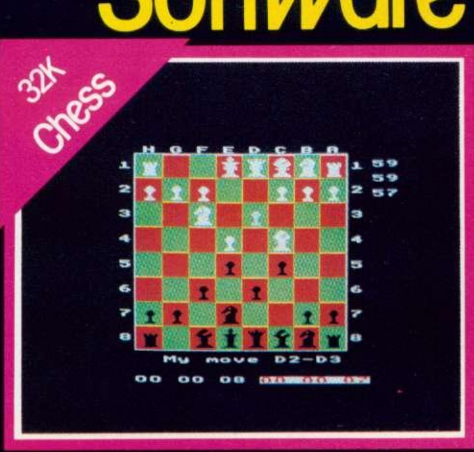
continued from page 121

```
370ŁBRKØORA4ERRØERRØERRØORA1ASL1ERRØPHPØORA@
380 ASLAERRØERRØORA6ASL6ERRØBLP9ORA5ERRØERRØ
390 ERRØORA2ASL2ERRØCLCØORA8ERRØERRØERRØ
400 ASL7ERRØJSR6AND4ERRØERRØBIT1AND1ROL1ERRØ
410 PLPØAND@ROLAERRØBIT6AND6ROL6ERRØBMI9AND5
420 ERRØERRØERRØAND2ROL2ERRØSECØAND8ERRØERRØ
430 ERRØAND7ROL7ERRØRTIØEOR4ERRØERRØERRØEOR1
440 LSR1ERRØPHAØEOR@LSRAERRØJMP6EOR6LSR6ERRØ
450 BVC9EOR5ERRØERRØERRØEOR2LSR2ERRØCLIØEOR8
460 ERRØERRØERRØEOR7LSR7ERRØRTSØADC4ERRØERRØ
470 ERRØADC1ROR1ERRØPLAØADC@RORAERRØJMP6ADC6
480 ROR6ERRØBVS9ADC5ERRØERRØERRØADC2ROR2ERRØ
490 SEIØADC8ERRØERRØERRØADC7ROR7ERRØERRØSTA4
500 ERRØERRØSTY1STA1STX1ERRØDEYØERRØTXAØERRØ
510 STY6STA6STX6ERRØBCC9STA5ERRØERRØSTY2STA2
520 STX3ERRØTYAØSTA8TXSØERRØERRØSTA7ERRØERRØ
530 LDY@LDA4LDX@ERRØLDY1LDA1LDX1ERRØTAYØLDA@
540 TAXØERRØLDY6LDA6LDX6ERRØBCS9LDA5ERRØERRØ
550 LDY2LDA2LDX3ERRØCLVØLDA8TSXØERRØLDY7LDA7
560 LDX8ERRØCPY@CMP4ERRØERRØCPY1CMP1DEC1ERRØ
570 INYØCMP@DEXØERRØCPY6CMP6DEC6ERRØBNE9CMP5
580 ERRØERRØERRØCMP2DEC2ERRØCLDØCMP8ERRØERRØ
590 ERRØCMP7DEC7ERRØCPX@SBC4ERRØERRØCPX1SBC1
600 INC1ERRØINXØSBC@NOPØERRØCPX6SBC6INC6ERRØ
610 BEQ9SBC5ERRØERRØERRØSBC2INC2ERRØSEDØSBC8
620 ERRØERRØERRØSBC7INC7ERRØ
```

Program 1. Atom disassembler with mnemonic text starting at line 370

Software for the BBC micro

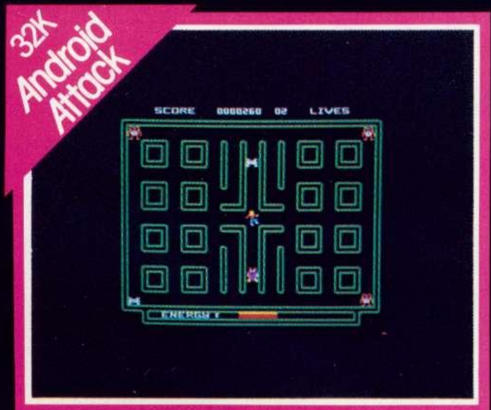
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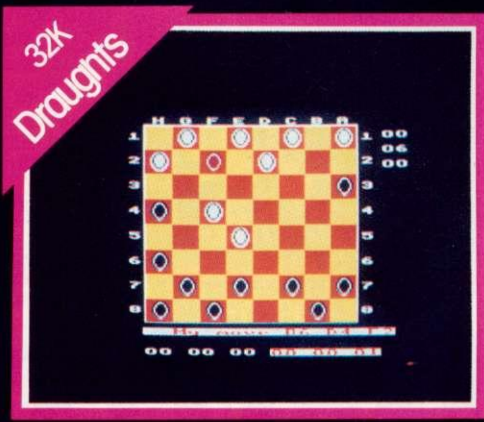
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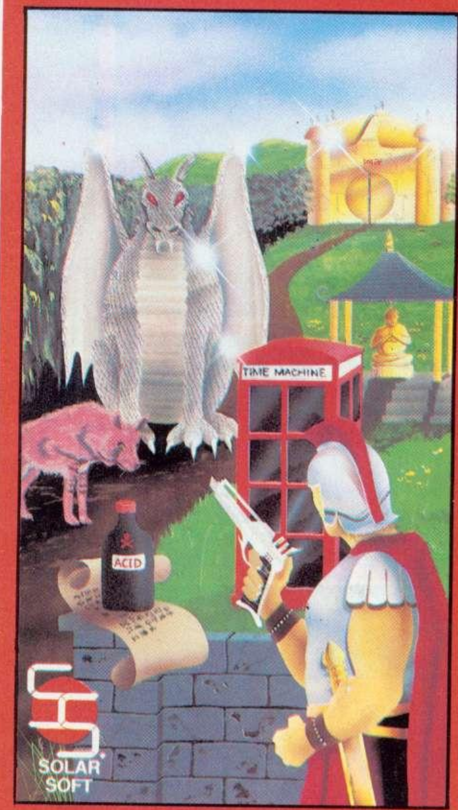






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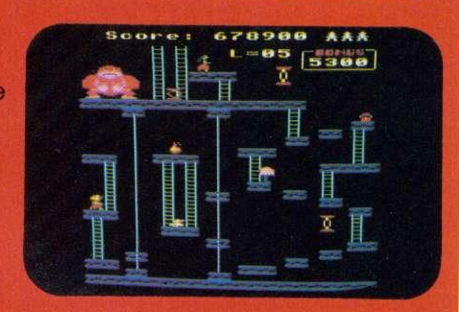


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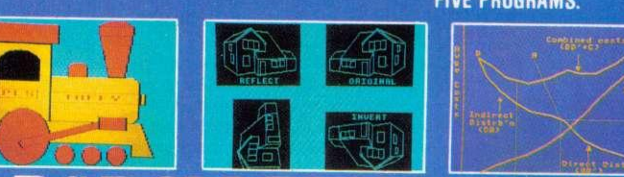
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Barry Pickles hosts this cash-for-tips column. Here's a chance to show off your talents—and earn some crinkly green stuff into the bargain. There are reckoned to be some 40,000 of you out there and, bearing in mind that the Atom has been around for more than two years, you must have accumulated a fair amount of expertise.

What we're looking for are those little routines, tips and hardware mods you've discovered. Don't worry if your little wrinkle seems too simple—it's probably just what someone else has been looking for. The same rules apply here as in Ian Birnbaum's Beeb Forum. Short, sweet and as original as possible is the name of the game. I'll start you off, but this is your page, so let's hear from you!

Send your ideas to Atom Forum, Acorn User, 53 Bedford Square, London WC1B 3DZ. If you want it returned, enclose a SAE. It should be typed or printed, with programs on cassette (with listing if possible).

JUSTICE FOR PIXEL GRAPHICS

THE Atom's pixel graphic set is much under-rated and yet some excellent displays are possible. It doesn't help, however, that the set may not be accessed directly from the keyboard, as on the Pet, for example. Listing 1 partly remedies this so that, by pressing CTRL-A the keyboard produces block graphics instead of alphanumerics. Pressing CTRL-@ restores normal use. Shifted keys produce white graphics, while unshifted ones give grey graphics. The entire set is not available – there aren't enough keys – but you get most of it. The graphics may be entered directly in program lines.

```
 5 REM: Keyboard graphics
10 DIM GG4; @=0; GG3=0
15 FORN=1 TO 2; P=#28BE; PRINT$21; [
20 :GG2 CMP@0; BEQ P+16; CMP@#7F
25 BEQ P+8; CMP@#21; BMI P+4; ADC@#80
30 :GG1 JSR#FE52; RTS
35 :GG0 LDA@(GG3/256); STA#209
40 LDA@(GG3%256); STA#208; LDA@0; RTS
45 :GG3 CMP@1; BEQ P+5; JMP P-21
50 :GG4 LDA@(GG2/256); STA#209
55 LDA@(GG2%256); STA#208; LDA@0; RTS
60 ]; NEXT
65 PRINT$6"LINK #"&GG0" AFTER A BREAK"'
70 LINK GG0; @=8; END
```

Listing 1. Block graphics from keyboard

FILE SAVING

IT IS sometimes useful to be able to load or save a file, while allowing your program to continue afterwards. However, the normal COS commands exit to direct mode, so we have to access the routines discretely. Entering at #FFE0 (to load) or #FFDD (to save) provides a solution, but both routines expect data to have been set up for them. The following two subroutines will do the job.

```
1000a REM: Load file
1005 x=#80
1010 $N="(filename)"; !X=N;
   X!2=#2900; X!4=#C2B2
1020 LI.#FFE0;R.

2000bREM: Save file
2010 $N="(filename)"; X=#80
2020 !X=N; X!2=#2900; X!4=#C2B2
2030 X!6=#2900; X!8=#3BFF
2040 LI.#FFDD; R.
```

In each case, X is made to point to the filename string ($N), X!2 is the start address, X!4 the execution address, X!6 the start address (only used by OSSAVE) and X!8 the end address.

It is interesting to note that OSSAVE has to synchronise to a reference frequency of 2.4kHz, as specified in the CUTS standard. The routine which does this is at #FCD8 and it can be used as a very accurate timer for delays. Such delays are often used in machine-code programs to slow things down. To use it, set the X register to a number between 1 and 255 and enter the routine at #FCDA. For each unit in the X register, there will be a delay of around 400 *microseconds* (the exact delay will depend on how accurate the oscillator in your machine is).

AUTO-REPEAT FOR KEYBOARD

UNLIKE many other machines, the Atom has no auto-repeat on the keyboard. It's very useful to have (even my typewriter has auto-repeat!), so listing 2 provides the answer. Writing it proved a useful exercise, as it sent me searching through the ROM to find out what I'd missed, and for ages it didn't work – the result you see is about version 26.

It's a partial rewrite of the Atom's own keyboard routine, with bits added. Line 30 sets up the delay before auto-repeat takes effect – in this case half a second. If you want a slower (or faster) delay, alter the LDX value. In line 45, we have the delay which sets the repeat speed. Here it is 4/60ths second, but again you may alter it using LDX.

As it is, it will repeat on all keys, except for the cursor controls. You can get round this by using CTRL-H,I,J and K instead – these will repeat. After a break, type !#20A=#3CA (or whatever address you assemble to). Disc users will have to use another assembly address, since #3CA is the start of DOS workspace. The routines called at #FEA4 and #FEB1 are part of the OSRDCH routine and convert the value returned by #FE71 to ASCII.

```
 5 REM: Auto repeat
10 P=#3CA; M=P; [
20 PHP; CLD; STX#E4; STY#E5
25 JSR#FE71; BCC P+9
30 LDX@30; STX#80; JMP#FEA4
35 DEC#80; BEQ P+12; JSR#FE66
40 JSR#FE71; BCS P-17; JMP P-12
45 INC#80; LDX@4; JSR#FB83
50 JMP#FEB1; ]
60 ?#20A=M%256; ?#20B=M/256; END
```

Listing 2. Auto-repeat for keyboard

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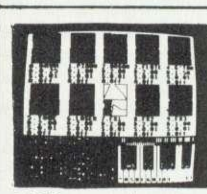
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LEVEL 9 COMPUTING

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HARDWARE HINT WITH LEDS

NEXT time you open the case, look at the upper half and you should see two holes, close to where the spacebar fits. On early issue Atoms, these held LEDs – what they did I'm not sure, but I've fitted a 'power on' light there. I was forever leaving the machine switched on overnight before this! All you need is a standard 0.2in LED and a 270ohm resistor, wired in series with the anode.

Now take a pair of wires to any convenient 0V and 5V points (I use pins 2 and 10 of PL4) and there you have it!

Any hardware hints that you have, I'll be pleased to pass on - as long as they are not likely to damage the machine.

£5

LIGHT-UP TIME FOR CAPS LOCK

THE Atom has no 'Caps lock' indicator like the Beeb and it can be very annoying to find you have accidentally hit the lock key. Peter Blenkinsop of Garston sent me a software routine to provide visible indication of the lock status. Peter's version failed to take account of scrolling, however, so I've modified it and made it relocatable. It uses timer 1 on the VIA to provide regular interrupts, polling the state of location #E7. If lock is active (ie, inverse letters), #E7 returns a value of #60, otherwise its value is 0.

The routine below pokes an inverse L to the top right-hand corner of the screen, if active, or a space, if inactive. Once run, it is disabled only by break and re-activated by LINK#2800 (or wherever you assemble it to).

The assembled code uses 64 bytes. Lines 50 and 60 alter the IRQVEC to point to this routine. Lines 70-120 set up the VIA. The remainder looks at the value of #E7, jumping to the appropriate routine. The PLA instruction on line 190 is needed to balance the PHA which is automatically performed on interrupts (see manual, page 193). Peter's idea earns him £5.

```
10 REM: shift lock indicator
20 PRINT$21; P=#2800; Q=P+34; [
50 LDA@(Q%256); STA#204
60 LDA@(Q/256); STA#205
70 LDA@#40; STA#B80B
80 LDA@#10; STA#B806
90 LDA@#27; STA#B805; STA#B807
100 LDA@#C0; STA#B80E; RTS
120 LDA#B804 .
130 LDA#E7; CMP@#80; BEQ P+19
140 CMP@0; BEQ P+10
150 LDA@#8C; STA#801F; JMP P+8
160 LDA@#20; STA#801F
190 PLA: RTI; ]
200 P.$6; LINK#2800; END
```

FORUM FAULTS

IT'S CRINGE time again. There were several errors in the last two Atom Forum's (not Barry's fault).

October's issue, page 77, listing 3. For COLOUR in line 40, read COUNT.

November's issue, page 75, listings 1-3. For LIST, read LINK. Finally listing 2, line 30 should read ADC@0, not ADC@A.

Our apologies, and thanks to those who pointed these mistakes out.

OS ROUTINES



SEVERAL readers of *Acorn User* have discovered routines in the Atom operating system and written to Atom Forum revealing their discoveries.

The following list of addresses is the result of 18 months playing around with the Atom by M Myatt, and earns him £10.

Abbreviations used are: Ec entry conditions; Exc exit conditions; Ru registers used (contents unpredictable).

C2F2	Basic interpreter entry point
Ec	location 5 and 6 (hex) should point to start of Basic program
C278	Shut file
C9D8	BRK service routine PC from stack into location 00(hex) Jump to Basic routine pointed to in locations 10 and 11 (hex)
CA4C	Print character in A and increment count
Ru	A,P
F6E2	Mode 0 point plot routine
Ec	X co-ordinate in location 5A,5B Y co-ordinate in location 5C,5D Clear point location 5E=0 set point on location 5E=1 invert point location 5E=2
F73B	Mode 1 point plot routine
F754	Mode 2 point plot routine
F76D	Mode 3 point plot routine
F7AA	Mode 4 point plot routine
F7FD	Print a space
Ru	A,P
F7F3	Print four-digit hex number
Ec	A holds high byte X points to low byte in zero page
Exc	X incremented by two
Ru	A,Y,P
F7F6	Print four-digit hex number
Ec	X points to two bytes in zero page
Exc	X incremented by two
Ru	A,Y,P
F802	Print A in hex
Ec	A holds number to be printed
Ru	A,P
FBEE	Get byte from tape
Exc	byte retrieved in A and added to checksum in location DC(hex)
FC38	COS messages
Ec	If C=0 prints 'Record tape' If C=1 prints 'Play tape'
Ru	A,X,Y
FC40	Prints 'Rewind tape' and waits for key to be pressed
Ru	A,X,Y
FC7C	Save byte to cassette
Ec	byte to be saved in A
Exc	Byte added to checksum in location DC(hex)
FDIC	Bleep
Ec	A must hold a positive number of which the second digit must be 4 or 5. The higher the number the shorter the sound.
Ru	ALL
FD69	Form feed/Home cursor
Ru	A,Y,P
FD74	Clear screen to mode 0/home cursor
Ec	A=40(hex),Y=0,B000=0,E1=0
Ru	A,Y,P
FD7D	Home cursor
Ru	A,Y,P
FE52	Write character in A to printer and VDU(if enabled)
FE55	As FE52 but not to printer
FE77	Print two addresses in hex
Ec	X points to zero page address 1 in X,0 and X,1 address 2 in X,2 and X,3
Exc	X=X+4
Ru	A,X,P
FEFB	Write ASCII in A to printer
Ec	A=02 to enable printer A=03 to disable printer

OS routines by M Myatt

FULL MARKS TO THE PHANTOM PILOT

737 Flight Simulator, Salamander Software, model B, £9.95



Game comes in sturdy plastic box, the size of a hardback book

COMPUTER simulation is a powerful tool, and nowhere is this more evident than in the training of aircraft pilots. Now I'm not going to suggest you can learn to fly a Boeing 737 on your BBC, but Salamander Software's simulator will give you a good idea of the complexity of flight (although the author, a pilot, isn't acknowledged).

A true aircraft simulator would have a cockpit view of the landscape, but memory restrictions in the higher resolution modes, make such a simulation difficult. So this package has you flying in bad weather conditions with low cloud, and only shows a cockpit view on landing and take-off.

The program is supplied on tape in a large plastic box, and comes with a 28-page flight manual. The manual provides excellent documentation and covers all the areas of the simulation – complete with a flying lesson for first-time pilots. I'll come back to the manual later, but the first thing we want to do is fly. The program comes in two parts with the first program setting up your options.

You are asked whether you want to use the present airfield or design your own, a very attractive option. This first menu allows the user to select the engine noise volume, the aircraft's stalling speed and whether the simulation starts from take-off or in mid-flight. Once chosen, the main program loads.

The manual explains each of the commands and a control key summary is provided. This is essential as there are 27 keys used, with more than 30 functions. When the main program is loaded, the lower half of the screen shows an instrumentation display panel and in the upper half, either a radar plot of the aircraft's position in relation to the landing field, or the cockpit view of the runway when taking-off or landing.

The flight deck instrument panel contains an array of information – more than I can cover here. The layout of this panel has on the left the 'blind' flying instruments (artificial horizon, compass etc); in the centre, fuel and power gauges, and on the right navigational displays and gear and flap indicators. The top of the screen contains warning messages such as stalling, as well as flap and speed information.

The flying lesson makes use of a very useful function, a pause key. This allows the flight to be frozen so the novice can refer back to the manual (or answer the phone). Take-off, flight, approach and landing are well documented and I found the instructions clear and lucid with good diagrams.

If you quit the simulation during flight (or crash), a second menu is presented. From this the pilot can choose to start again from take-off or a new layout; go to a landing position; continue from the present position or set up a new position. Hence, the pilot can choose the initial position of the aircraft, the bearing and distance from marker beacons around the runway, and the aircraft's speed, altitude and heading.

If the preset airfield option is not chosen, a new layout can be set up. This includes changing the speed and direction of surface wind, stalling speed and position of aircraft. To set up your own airfield requires a little work with pencil and paper but is worth the effort. This means you're not restricted to running the same simulation every time.

Overall, I was impressed by the thought put into this package and its presentation. The manual is one of the best I have seen with software and the program is well presented with good on-screen prompts and accurate sound effects.

Certainly the best flight simulator I've flown, complete with suggestions for further reading, where to obtain airfield charts – and a phone number for help. Full marks to Salamander.

Jeremy Vine

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3.2
071
3.5
235
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M .--
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VOR 2 o
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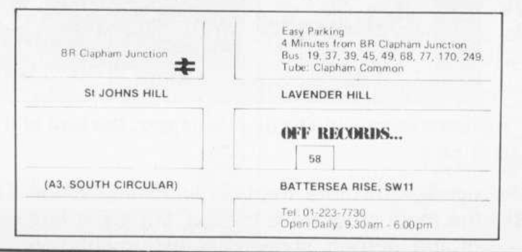
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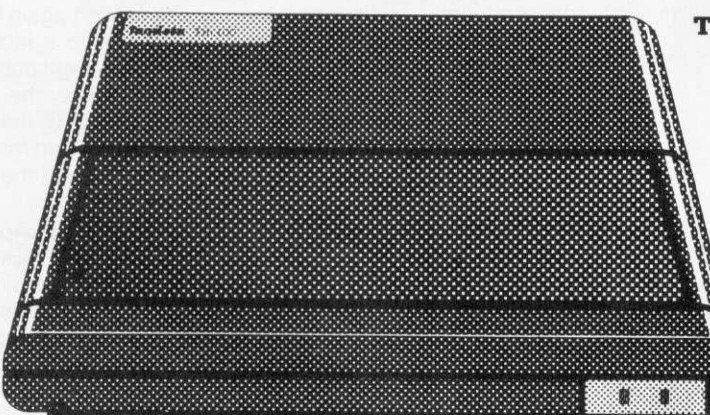
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USEFUL IN SCHOOL – WITH RESERVATIONS

Learn Addition, Learn Subtraction, Anthony and Olive Pickering, ABC Primary Software, 19 Crumstone Court, Killingworth, Newcastle-upon-Tyne NE12 0SZ, £6.50 each (£9.50 disc). 20% discount for LEA bulk purchase

THESE two suites of programs come with helpful documentation giving specific objectives, program details and suggestions for their use including the statement that each could occupy a five-to-seven-year-old for, on average, 5-10 minutes. They have apparently been given a five-star rating as part of the national listing produced by the MEP.

Learn Addition consists of three linked programs which aim to develop young children's ideas of addition through counting blocks and using the number line. The programs load easily and the modular format allows the pupil to see the menu before loading other sections of the program.

The sound effects can be removed by pressing the TAB key when the instructions are displayed. (This is a great improvement on earlier versions where the user had to issue a *FX command before loading the program.)

The first module, *Block*, asks children to count two piles of blocks by pressing the space bar once for each block. As the space bar is pressed a block is added to a new pile and the counter changes to show the symbol for the number. If the space bar is pressed too many times, the excess blocks can be removed with the delete key. The module consists of 10 questions, randomly generated, which are repeated twice for incorrect responses before the correct answer is shown, and a total score at the end.

The idea is developed in *Block-Line* where the blocks are shown positioned on a number line. The arrow keys can move a marker back and forwards along the line but this seems to have nothing to do with the answer which has to be entered as so many presses of the space bar.

The final module, *Test*, is a set of 10 simple addition sums where the pupil types in the answer and is told if it is correct and is given a score out of 10 at the end. The program used to accept the return key as an input, but this has been corrected in later versions. However, it still cannot cope with an answer typed before the very slow drawing of the equals sign is completed.

The accompanying notes suggest that Unifix structural materials may be used to supplement the program. Only the first module seems to add anything to the use of Unifix because the pupil gets immediate feedback and this should reduce the chances of errors being practised. *Test* seems particularly pointless and could just as well be carried out on Little Professor at a fraction of the price, thus freeing the BBC for better use.

Learn Subtraction is based on similar ideas. The first module helps the user to find the difference between two chains of blocks which are built by pressing the space bar. The computer checks that each chain is the specified length, a useful activity that a workcard cannot provide, and then asks the pupil to complete a number sentence about the difference between the two chains.

Picture-Subtract does not teach the user subtraction and fundamentally only records if the user can count. A tree is displayed with birds in it and the pupil counts how many birds there are. Some of the birds fly away, or at least disappear, and the pupil has to say how many are left. The correct subtraction sentence is displayed on the screen. The third program, *S-Test*, is similar to the test in the addition package.

Again, only the first program is really good. The first objective of the package is supposed to be to enable the user to acquire a knowledge of the operation of subtraction in the three aspects of finding the difference, physical removal and movement on the number line. Only the first is successfully achieved and it is unlikely that use of this program will improve knowledge of the number line.

Block Add and *Difference* could be helpful for younger pupils, but at this age many teachers will prefer to talk to pupils in a small group rather than letting them use the computer for this activity. Most infant teachers ensure that the necessary practical experience precedes abstract manipulation and they may therefore find these programs a useful addition to their current work.

Paul McGee

GOOD THINKING

Let's Count, Applied Systems Knowledge, London House, 68 Upper Richmond Rd, London SW15, model B, £9.95

HERE we see a system apporach to a set of four educational programs from a software house. The authors have given some thought to the fact that young children have trouble with reading, and so a set of clearly-defined symbols has been designed to aid the pupil. Good use is made of colour and music (which can be set to a level). The manual is clear, and comes in a small carboard box with the tape.

The pupil only ever has to touch two keys – the space bar and return key. Clear loading details are given, and a second copy of the programs is on the other side of the tape, although because of the protection against copying, loading the different parts is tedious.



Handy booklet with packaging

There are four number ranges, which are set up by the teacher, 1-3, 0-4, 5-9, 0-9.

Treasure Island prints a number of islands in a blue sea and a boat loaded with several objects. Simply pressing the space bar moves the boat down the screen until it is opposite the required island. Hitting the return key draws a ring around each object and a tune is played.

Space Stations places some objects in the sky with a numeral in each. A rocket can be moved across the screen with the space bar, and if it is opposte the correct 'star' (and return is hit), it takes off with some suitable music.

Roll a Ball begins the pupil on ordering numbers with a numbered skittle alley. A ball can be moved left or riht to the alley with the lowest number, and hitting return places the number on a post at the side of the screen, and so we continue with all the other alleys.

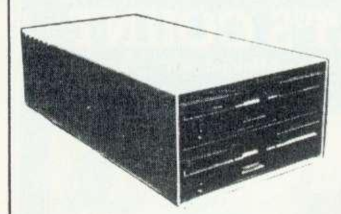
Which Way introduces comparisons of numbers of objects coloured red and blue. A three-way frame is used with the left tube for objects more red than blue, the centre tube for equal shades, the right for more blue than red. A pointer swings above each tube in turn by pressing the space bar. When it is above the correct tube, hitting return moves all the objects down, and groups them tidily rather than have them jumbled up, as they were when the pupil was asked to sort them.

The programs are well written and well thought out, making good use of the machine, and its many abilities. They may be of use at home for a limited period, provided that is how the teacher is planning to tackle the work at school.

Paul Garfield

CUBE extends your BBC micro

Disk Drives for BBC



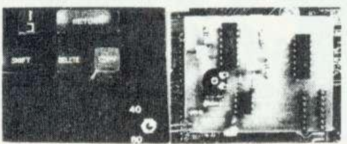
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All versions are supplied in cream textured metal box complete with power and data cables and disk and manual with games and utilities. 2nd drive can be added later to single drive units.

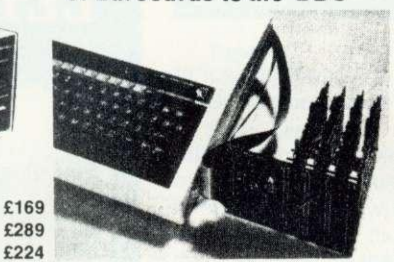
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Supertrax plugs into existing sockets on the BBC. No soldering or track cutting is required. The switch fits into an existing hole in the BBC case; only the plastic film needs to be pierced. 3 position switch selects (a) all drives 80 track (b) one 80, one 40 track (c) both drives 40 track. Supertrax takes about six minutes to fit.

BEEBEX opens the world of Eurocards to the BBC



BEEBEX 4 socket unit — £64

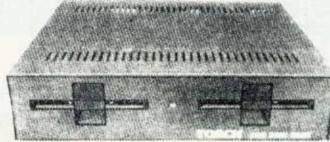
BEEBEX takes five pages of explanation in our catalogue, and CUBE Eurocards a further 44 pages, so the best guide to their power can be obtained by sending for your free copy.

BEEBEX provides an external additional 1 Megabyte address space for the BBC, via its 1MHz bus connection. Up to 15 CUBE modues can be accomodated simultaneously, eg 975 KB of dram.

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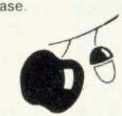


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PERFECT WRITER - sophisticated word processor
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picoNET

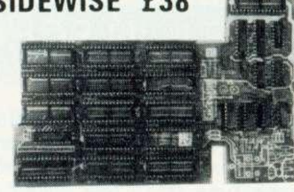


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Each station (sideways ROM) costs **£35**
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picoNET is available NOW, is easy to understand and use, and can be cabled so that the system can be later upgraded to Acorn Econet.

Each user can save and load BASIC and machine code files on the central Apple, and any station can be nominated to perform printer duties. MASS DOWNLOAD allows every station to simultaneously receive the same program for the central unit.

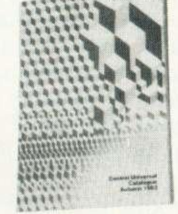
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The best ROM carrier yet for BBC micro.
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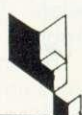
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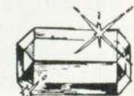
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GEM Software . 1 Oswald Road . Leamington Spa . Warks CV32 6EW

Bruce Smith takes four books off the shelves from various publishers

GOOD START WITH PUFFIN DUO

Micro Games, by Patrick Bossert and Philip Dickinson, Puffin Books, £1.50, 134 pages.

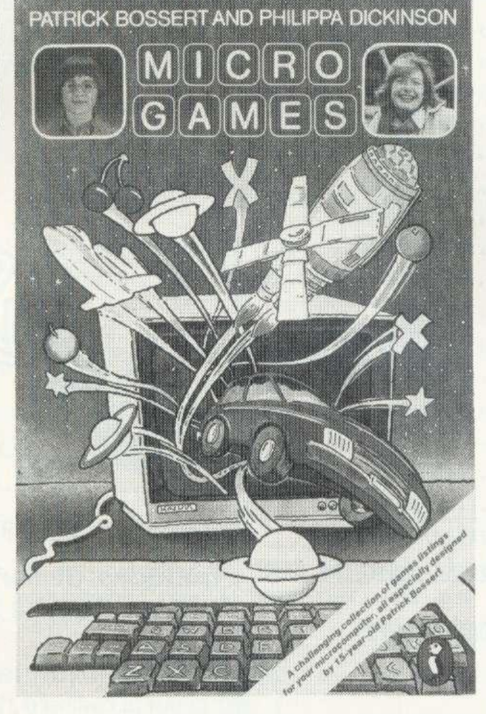
REMEMBER the Rubik Cube? Patrick Bossert certainly does, because he wrote the 1.5 million copy best-seller 'You Can Do The Cube'. This clever 15-year-old has now turned his hand to writing a very good introductory computer games book with Philippa Dickinson.

Micro Games caters for owners not only of the beloved Beeb, but also RML and Sinclair machines. This, you might think, could lead to confusion, but this is certainly not the case, possibly because the text is written very non-specifically to make it applicable to each machine listing!

Thirteen programs are described, 10 of which will run on an A or B Beeb. The ones of interest to us are Bouncers, Breakout, Asteroid Belt, Danger Orbit, One way Street, Miner, Snake Run, Magic Square, Pickup and Fruit Machine.

Each listing is broken down into short digestable sections which are discussed in the accompanying text. At the end of each chapter suggestions are made on developing the programs. The listings themselves are crisply produced from a good dot-matrix printer. The introduction to the book also includes a trouble-shooting guide to help winkle out typing errors. My favourite program? Definitely Pickup: those bogeymen won't get me!

At £1.50 this is an extremely good buy for those new to the world of home computing and would make an excellent stocking filler, so get your letters off to Father Christmas's wife, Mary now!



GET STUCK IN WITH DEESON

Easy Programming for the BBC Micro, by Eric Deeson, Shiva Publishing, £5.95, 128 pages.

AS ITS title suggests, this book is explicitly an introduction to programming the BBC micro, and as such stands up very well. Assuming you have little or even no experience with home computers, the first chapter explains exactly how to 'get stuck in' – from the initial fury of opening the box to running the Welcome cassette.

The next few chapters discuss various aspects of programming and include short but logical examples. At this stage a discussion of program planning is also included, pointing out how a structured program should look and be developed. It's nice to see this so early in a book – start as you mean to go.

Chapters 5 to 15 examine the fundamentals of decision-making loops, procedures, flow charting and string manipulation. All of these end with a list of suggested projects related to the chapter contents.

Chapter 16 takes time out to show the common types of errors that can creep into programs, something most beginners' books ignore.

The final chapters move into the more advanced aspects, from a beginner's view, but, as with the rest of this book, they are approached in a friendly, chatty style.

As introductory books go, this is by far the best I have encountered and would thoroughly recommend it.



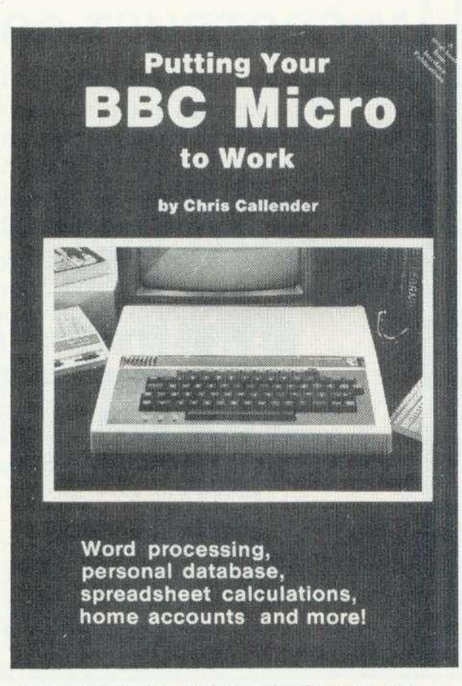
FADE AWAY WITH INTERFACE

Putting your BBC Micro to Work, by Chris Callender, Interface Pubications, £4.95, 111 pages.

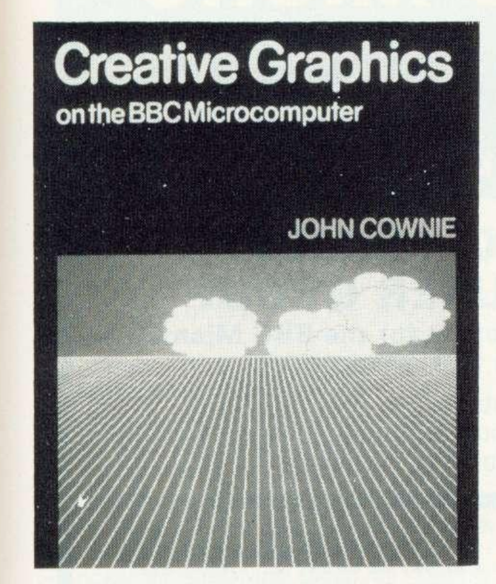
A MORE apt title for this, the latest offering from Interface, would have been *the* book of listing. Not because it is the definitive listings book, but because it is virtually all listing. Of its 111 pages only 25 have any text. the 15 programs, written in Basic, include a word processor, database, a planner, a spreadsheet, home accounts, telephone directory, stock control, mailing list, cardfile, work control, and calendar. All these seem fairly standard, and similar programs have been published numerous times in several popular computing magazines.

Two programs which did attract my attention were Matrix and Electronic Circuit Design. The former can perform addition, subtraction and multiplication of matrices up to a 12 × 12 order. The latter allows 17 predefined electronic symbols to be positioned on the screen, and very simple circuit diagrams to be constructed and output to a printer.

page 135 ►



Nearly all listings of standard programs



WELL-PRODUCED STUNNER

Creative Graphics, by John Cownie, Acornsoft, £7.50, 110 pages.

CREATIVE GRAPHICS is a well-produced book, and although I would not recommend it for beginners, the programs do provide stunning examples of what the Beeb can do.

The book opens by giving an overview of the graphics commands and describes the operation of the colour palette. The rest of the book is centred around 36 listings demonstrating various aspects of graphics. A black and white picture is included for many of the programs and 16 colour plates are included showing the results of the more spectacular programs.

So just what aspects of graphics are covered? Chapter 2, Functions and Symmetry, includes three ways of drawing a circle and PROCJACK, which draws the Union flag (everyone stand up). Things hot up in chapter 3 as The Third Dimension is investigated. The programs in this section produce some very pleasing results with spheres, cubes, planets and mountains!

Animation is introduced next and the programs here include Kaleidoscope, Flat Spiral, Multicoloured Spiral, Beachballs and then my favourites, Rotating Squares and Rotating Fan. Chapter 5 introduces recursion and shows how this repetitive process is exploited.

Finally, chapter 6 makes use of the techniques previously described to build up more complex pictures. These include Windy Field (used on the cover) Merry-go-round, Desert Island and Rainbow (which was used on the cover of the very first issue of *Acorn User!*). All these pictures are broken down into short procedural listings that the reader could use to construct his or her own pictures.

In short, an excellent, well-produced book – a must.

Bruce Smith

▶ page 133

The final program Boss (that's business oriented software system) is a 22-page listing that the author suggests we type in gradually 20 lines per night (by my calculations it would take a month). Boss itself is just a menu-driven version of seven programs, all of which are listed earlier in the book.

The listings themselves are produced on a dot matrix printer (with no lower case descenders) and in many instances fade away, rendering them almost unreadable. All programs will run on a model B and, with the exception of Boss, they can all be modified to run in 16k.

I find it difficult to agree with the blurb on the jacket that this is 'another great book from Interface Publications'.



BEEBUG FOR THE BBC MICRO

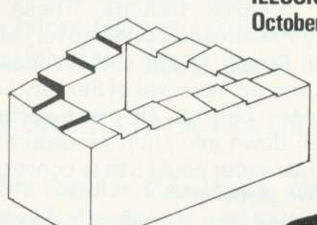
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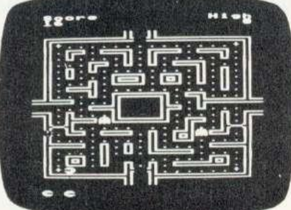
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SCREEN SHOTS FROM PROGRAMS IN BEEBUG



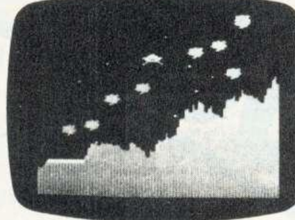
ILLUSIONS
October 1983



MUNCHMAN
October 1983



3D SURFACES
October 1983



MARS LANDER
Aug/Sept 1983



SPIDERS WEB
Aug/Sept 1983



ELLIPTO
JUNE 1983

Magazine programs now available on cassette at £3.50 inc: VAT & p&p—see *BEEBUG magazine* for details.

July issue: Games: Robot Attack (32k) and Anagrams, a 16k word game. Watching the Beeb at work—a sample program to show your micro at work. An introduction to discs—what are they and are they worth getting. Balloons—a coloured animation. Make your micro speak like Kenneth Kendal. Bad Program Lister—lists programs even when the computer pronounces them 'bad'. Reviews of Epson and Seikosha's new printers. Five books of programs reviewed, plus more software reviews. Using Files Part 4. A full disc sector editor program—to read and retrieve lost disc files, and how to modify Acornsoft's Planetoid. Plus hosts of useful hints.

Aug/Sep Issue: Games: Space Lords (32k) a two-player space battle, and Mars Lander (16k). Build yourself a light pen—a simple explanation for the beginner, together with a sample program. Use our "Contact Points for the Beeb" to discover who to contact when in need. We show how to put those 'awkward' cassette programs onto disc. Final instalment of our popular 5-part series on "Using Files" REVIEWS of—MICRONET, Watfords Electronic's Disc Filing System, two EPROM programmers, and the tax advisory package "Microtax". This month's visual programs include Spider's Web, Super Large Screen Characters, Bounce and Swing. We also show how to hold two complete screen pictures at once, and switch rapidly between them in "Dual Screens on the Beeb". A Crossword, Brain Teaser and our 4th Software Competition provide a competitive edge to this month's magazine. We also have our very popular scattering of Hints and Tips.

October Issue: Games: **Munch-man**, a Snapper type game with super graphics, **Illusions** graphics and sound you won't believe. A versatile **Renumber** program for Basic, **Fabric Patterns**, an invisible **Alarm Clock, Disc Sector String Search** and a program for drawing **3D Surfaces.** Articles on the **Teletext Mode** for beginners, **Compilers and Interpreters**, using **Joysticks**, using the **Speech Synthesizer** and more. Reviews of two **Cassette Recorders** (Marantz Superscope C190 and Acorn Data Recorder), three **Printers** (NEC pc-8023B, STAR DP840 and CP-80), amnd lots of new games software (and we've arranged **SPECIAL OFFERS** for members). Plus a review of the new **Acorn Electron** and news of our new magazine for Electron users called **ORBIT**. Plus all our usual features like Hints and Tips, Postbag, and a new Brainteaser.

November Issue: Program Features: **Reversi**, a challenging board game, **Lunar Escape**, an addictive arcade type game, **SNARFER**, a very useful disc recovery program, **SHAPER** for defining multiple character shapes, **RAPIDS**, another short game, **DEMOLITION**, a sizzling display with matching sound effects. Plus articles on a **Clock Display**, the **Teletext Mode** (part 2 of a series), an Introduction to **Interrupt Programming**, a new **Mode 8** and The Beeb in Slow Motion. Plus **Extension ROM Board Reviews, Games Reviews, Book Reviews, M-TEC Torch Basic Review.** Plus News, Hints and a new Competition.

BEEBUGSOFT: BEEBUG SOFTWARE LIBRARY
offers members a growing range of software from £3.50 per cassette.

BEEBUG NEW OPERATING SYSTEM OFFER

BEEBUG members can now obtain the new **1·2 OPERATING SYSTEM ROM** at around **HALF PRICE**
As a result of **BEEBUG** negotiations with Acorn the **ROM** now may also be offered by other user groups to their members.

1. Starfire (32K). **2.** Moonlander (16K). 3D Noughts and Crosses (32K). **3.** Shape Match (16K). Mindbender (16K). **4.** Magic Eel (32K). **5.** Cylon Attack (32K). **6.** Astro-Tracker (32K).

Utilities: 1. Disassembler (16K). Redefine (16K). Mini Text Ed (32K).

Applications: 1. Superplot (32K). **2.** Masterfile (32K).

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Send editorial material to: The Editor, BEEBUG, PO BOX 50, St. Albans, Herts AL1 2AR

DOCTOR'S NAME TAKEN IN VAIN

Doctor Who, BBCSoft, model B, £10

THE BBC's reputation for high standards in their publications does not seem to extend to this piece of software. The first set of software packages released by the BBC was disappointing and *Doctor Who – The first adventure* is even worse. The name of the good Doctor is used as an excuse to string together four poor versions of well-known, arcade-type programs.

Loading the Beeb's Doctor Who package is an adventure in itself. Whoever is responsible for writing the loading sequences for this tape wins my 'Boring presentation of the year' award. The on-screen information is at times non-existent or, if present, usually scrolls part of the instructions off-screen.

The amount of files needed to load these 'adventures' is a perfect cure for insomnia.

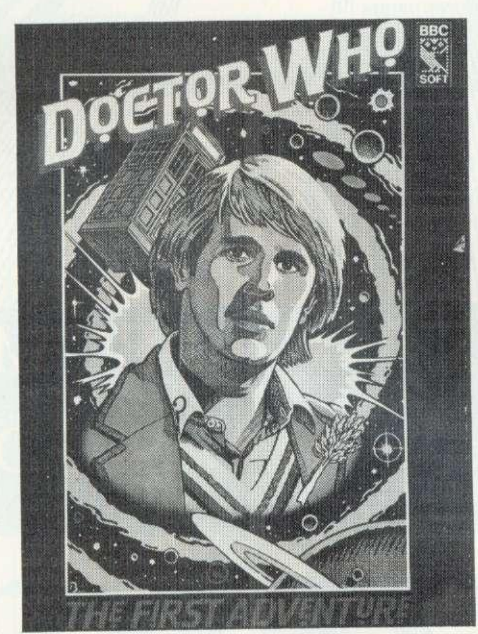
One loads the introduction, which plays the Doctor Who theme tune and draws the Tardis. Three more files must be loaded to play the first game, four for the second, two for the third, and fourth, then finally another file for the high-score table or failure message.

Stifling yawns, I managed to stay awake long enough to play the first game, which is set in a underground labyrinth. The screen depicts a maze of underground tunnels and the objective is to move a buggy around the maze collecting three segments of the 'Key to time' (time is something you need a lot of to play this tape). Of course, in true *Pac-Man* style you are being chased by wriggling white lines (worms) who are intent on killing you.

Throughout this 'adventure' you have 15 lives and one galactic hour to complete the four games. If you fail any of the games, the whole loading procedure must be repeated to play again! Even more outstanding is the fact that to obtain a message informing you that you have failed, one has to load (surprise!) yet another file at the end of the tape. Therefore if you fail the first game you have to go through eight files to get your failure message.

The second game is a limp version of *Frogger*. The aim is to reach a prison by crossing the defences. First of all a highway must be crossed (did someone say defences?); then a moat, by jumping on the backs of various creatures, and finally a forecourt. The Doctor is represented by a matchstick man which is presumably the best character definition the BBC can give him. What makes this game so bad is the graphics. There is so much shuddering on the screen I thought I was using a ZX81.

The third episode sees the Doctor, or in this case a spaceship, fighting against birds (terrordactyls) swooping down on you. Sound familiar? It should do. This is a



Not an adventure, but four arcade games together

derivative of *Galaxians* and is a passable version, though I found it easy.

Finally, if you are still alive (or awake), you reach the Box of Tantalus. Here you are faced with a cubic grid, and the task is to find the four alien patrols and destroy them. You are supplied with 25 detector rays, which are sent into a quadrant. If aliens are detected, one has to then destroy them by releasing one of six torpedos. The problem is to find the correct coordinates within that sector with which to destroy the alien patrol. This game is nothing short of a cut-down version of *Star Trek* and there is little here to maintain interest.

The tape comes with a 15-page booklet which is more entertaining than the game. To call this a Doctor Who adventure is misleading. This package is a collection of games which are extremely poor in their presentation and content, and is certainly no adventure. The only standards the BBC has set with this package are those to be avoided.

Jeremy Vine

PATIENT ASSET

Number Cruncher, Oxhey Tutors, model B, £6.50 (disc £9.50)

THE great asset of a computer for education is its infinite patience – a facet well shown by *Number Cruncher*, a one, or two-player program to test arithmetical skills.

After the title screen, a menu of six options appears (five in the case of two players): subtraction, addition, multiplication, division, mixed problems and directed number. The level for the player can be chosen and in the case of addition or subtraction, the choice of number between 0 to 12 or 0 to 99.

page 139 ▶

UNBALANCED

Number Balance, Acornsoft/ESM, model B, £9.95

THE usual Acornsoft packaging greets us, and the initial drawing is very common to primary schools across the land, the balance arm. However, it is a shame not as much thought has gone into the reading ability of young children. Not such good use is made of colour, and there is no music. There is no manual – Acornsoft assumes the user has used their packages before I suppose. Why is there no second copy on the back of the tape? And then there is the usual multiple segment loading because of protection.

The teacher has a great deal of setting up to do, and some useful information is given. There are two main programs, one deals with sums that balance using addition and subtraction, the second uses the same layout and deals with multiplication and division.

The teacher can set the missing part of the equation in the form: $x +/- y = z$, then the size of the highest value, whether signs are random or fixed and, rather confusingly, the time.

The pupil can now make a start! The screen messages are rather difficult to read, and some help would have to be given in the first instance. A big balance comes on the screen and by simply hitting a number key, the number appears in place of the question mark (no hitting the return key), a correct answer makes the arms balance, and a simple tick appears in the corner of the screen. If the answer is wrong, it tries to move but returns and a cross comes after two goes.

When we come on to multiplication and division there are limitations which teachers would not like to accept. The maximum result can only be 99, so the 11 and 12 times of all the tables up to nine are missing. This is done for clarity as mode 5/2 characters are used on the screen.

Paul Garfield

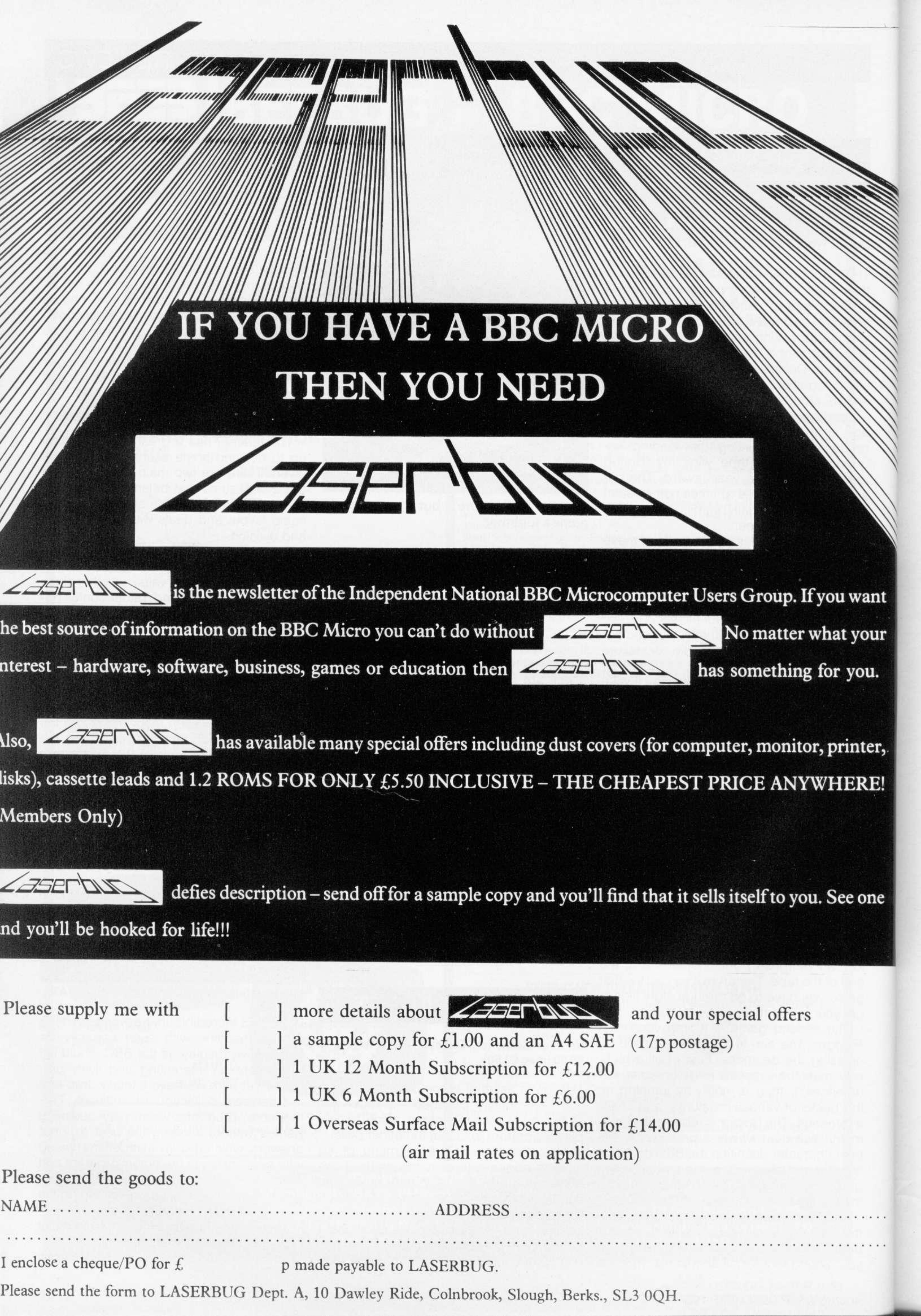
BAD EXAMPLE

Mathematics, Simon Software, £4 plus VAT

IT SEEMS incredible that anyone, working with a machine with such capacity for imaginative display as the BBC, could fail to present an interesting and lively program. Yet here we have a totally drab and ill-organised collection of software. Furthermore, programs which play guessing games without allowing the user to input answers, which display instructions having little relationship to the actual program and which are thoroughly confusing as well as generally being pointless, are bringing the software industry into disrepute.

This collection is an excellent example of how *not* to present your material.

Nick Evans


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DUTCH ROM IS WITNESS TO ATOM'S FAME

AXR1 utility ROM, ECD Computer Workshop, 98 guilders

IT SEEMS that the Atom's fame has spread far and wide, as this utility ROM (as usual, it's actually an EPROM) originates from Holland. The 4k AXR1, Atom Extension ROM, arrives neatly packaged in a plastic box, and is accompanied by an instruction manual and demonstration tape.

To use the AXR1, the floating point ROM *must* be present along with the 6522 VIA. Link 2 on the Atom's printed circuit board must also be connected. Installation proved easy, even though the manual fails to point out which way round the EPROM should be positioned. Once installed, 19 new commands are available for immediate use. No address LINKing is required as the AXR1 makes use of the default jump address, to the utility ROM, via the FPR interpreter.

Now for the commands. READ,DATA and RESTORE allow numerical values and character strings to be readily accessed. RESTORE is targetable to a specific line and DATA statements need not be confined to separate lines.

FIND searches the current text space program for a designated string, eg FIND"PRINT", listing any lines where it occurs. If an address is given as the FIND argument, this is interpreted as the address in memory where a string of characters are located, ie, FIND $#2800.

RENUMber is a standard implementation, with any calculated jumps such as GOTO (A-2) listed, otherwise all GOTOs, GOSUBs and RESTOREs are altered to match their new destinations.

FCOS provides a 1200baud cassette operating system interface which may be reset to 300baud with SCOS. Visual indication of LOAD or SAVE is provided by a greying of the cursor, but this is not particularly distinctive.

HDUMP produces a nicely-formatted hex dump of an area of memory, while XDUMP will also print any relevant ASCII character above the hex number.

A DISASsembler is always useful, and this version is fairly standard. Branch displacements are displayed as absolute addresses, ie, BNE#FBE4, and any illegal instructions, such as data, are displayed as '???'.

Blocks of memory may be COPYed to another area of RAM, while RELOC will also adjust absolute addresses relative to their new locations, so JSR#F80B would become JSR#300B if it was relocated to the same position on page #30.

PLAY allows tones of any length and in a three-octave range to be produced on the internal speaker. KEY performs a single keyboard scan, placing any detected key's ASCII value in a specified variable.

ON ERRor allows you to define your own error handling in a Basic program. Any number of ON ERR statements may be included, with control being passed to the last one encountered should an error occur.



Cassette comes with ROM

If you are particularly interested in machine code programming or finding out how the Basic interpreter works, then STEP will instantly appeal to you, as it allows a program to be executed one step at a time. As each instruction is completed, the current address, mnemonics, and values of the accumulator, X, Y registers, status register and stack pointer are displayed. If a second address is entered after the STEP command, eg STEP #C2B2, #C309, the utility will only start stepping after completion of the instruction located at the second address, ie, it will execute the machine code between #C2B2 and #C309 and then STEP the following machine code. Very useful.

SHAPE allows predefined shapes to be plotted in any graphics modes. A shape table must first be placed in memory which consists of a series of bytes which determine the movements of the graphics cursor. Each byte contains two plot and move functions. For example, if the following bytes were placed in memory from #2800, the command SHAPE#2800 would interpret them thus:

#2800 #04 length of shape table, ie four bytes.

#2801 #99 move right and invert point (twice).

#2802 #BB move down and invert point (twice).

#2803 #88 move left and invert point (twice).

#2804 #AA move up and invert point (twice).

In other words, draw a square with the half-way point of each side marked.

GRMOD effectively allows normal teletype procedures to be carried out in graphics mode 4. Used with PRINT it is particularly useful for labelling graphs and displaying scores in games. Unfortunately, no lower-case characters are available, these appearing in inverse video. This can be useful, however, for printing on an inverted screen. TXMOD retrieves the normal teletype mode.

The demonstration tape contains five Basic programs to demonstrate the AXR1 commands. Included is an editor for designing shapes and shape tables, and, for the worried man, an Atom psychoanalyst. Ten zero page bytes are used by AXR1 between #90 and #99, and a further seven error codes added to the Atom's own repertoire.

In summary, the AXR1 contains several good, useful facilities, but lacks an automatic line numbering command and DELETE to complement RENUMber, two commands I consider essential for any utility ROM. The presentation is good and the inclusion of the taped examples an excellent idea. The manual contains detailed explanations of each command, illustrated throughout with copious examples.

The AXR1 costs 98 guilders (about £23) and is available from: ECD Computer Workshop, Voldersgracht 26, 2611 ev Delft, The Netherlands.

Bruce Smith

PATIENT ASSET

►page 137

The program itself is a question and answer game against the clock. If the child provides the wrong answer, the program continues until all the questions are asked. If there is time remaining (shown by a row of boxes on the screen), the questions are asked again. The program then gives a percentage score of those questions answered correctly and proceeds to give the corrections. However, the child must enter the correct answer else the question will be asked again.

Number Cruncher is a simple program, with no distracting displays, but there was one 'bug'. During the correction routine, if the child enters a four-digit answer, it is not overwritten with the correct answer.

Clear instructions are provided and details on changing the number of questions asked and the times allowed. Overall I found *Number Cruncher* a competently-written program which will last for quite a few years.

Paul Richard

John Corder assesses seven educational programs from Chalksoft, but finds them lacking

IN THEIR literature, the Chalksoft authors claim they are 'a group of teachers and programmers' and that '. . . all our programs are throughly tested with children, often in a classroom situation'. I am afraid that the primary school children who worked with me on these programs found most of them lacking in stimulation and I see little use for them in my school.

Angle (£8.95), Inkosi (£5.95), Man (£5.95), Letters (£9.95), Metrics (£9.95), Pascal (£5.95), Sequences (£5.95). Chalksoft, Lowmoor Cottage, Tonedale, Wellington, Somerset TA2 10AL.

ANGLE

Angle consists of four programs, the first of which proved extremely difficult to load. Program A introduces whole, half and quarter turns, then 45°, 60°, 30° etc. When the small circle which represents 'degrees' was introduced, it caused some confusion by appearing as a full stop instead of an open circle. The pupil has no opportunity to estimate and check angles before proceeding, and some of the displays were extremely difficult to read, especially when white was used on a yellow background. Program B gives 15 multiple choice questions on the sizes of angles by drawing a section of a circle and offering four possible answers.

Program C introduced 360° and 180° protractors and demonstrated their use. Unfortunately many of the key instructions were virtually invisible because of the yellow script on a white background. Acute, obtuse, reflex and right angles are mentioned at the end but there is no test of the pupil's knowledge; the only interaction is to press the space bar.

The final program D, must be loaded to test understanding of C. Angles are measured directly on the screen and are chosen as either acute, obtuse, reflex or right. A 5° margin of error is permitted which led to problems in measuring a right angle. Because of the curvature of the monitor screen, it only measured 85° and the user correctly defined it as an acute angle. Disappointment ensued. Two sound envelopes are used for right and wrong responses and a display of the number of errors is shown. However, these are not analysed, nor is the teacher able to recall them.

MAN & BOY

Inkosi is a game similar to *Yellow River Kingdom* (BBC Welcome tape) set within an African tribe called the Inkosi. The player has to survive by not losing too many members of the tribe, while growing maize as food and to trade for cattle. Raids by the Umo tribe, lions and rats also need to be countered. We found it rather slow with a super-abundance of repetitious sound effects.

Man requires the user to find a hidden matchstick-type man on a 10×15 grid, using compass bearings. There are three levels of difficulty, and the time taken and the number of attempts needed are recorded. Once part of the man is found in one square, the user has to find the rest of his body in adjacent squares. We found that we plotted part of the man on several occasions but the program did not acknowledge it. Also, the display of his arms is so thin that we frequently didn't realise we hadn't plotted them.

LETTERS

Letters is a series of five programs which draw screen-sized lower case letters for young children to follow or copy. The letter shapes are taken from Christopher Jarman's book *The Development of Handwriting Skills*, and the initial program acts as an introduction for parents and teachers.

Family 1 draws a group of letters, b, h, k, m, n, p and r, which have a number of characteristics in common. The user selects which letter to draw by pressing the appropriate key. This letter is then drawn slowly on the screen and one has the option of employing a trace, which appears to draw the letter and leaves a trace behind, and a sound system which rises and falls with upward and downward movements.

Family 2 draws the letters a, c, d, e, g, o and q. Family 3 deals with f, i, j, l, t, u, and y, and Strangers displays the remaining letters. Despite attempts to load them using a variety of recorders, Family 3 and Strangers failed to load, so we were unable to investigate them.

We liked having the facility to trace over different letters in the same family to see what they had in common, and it was also useful to be able to repeat a letter continually. However, some of the four- and five-year-olds who tried the programs and wanted to switch the sound or tracer effects on or off couldn't do so as they couldn't read the instructions. This means that they had to get their teacher to do this, thus disturbing the other activities she was involved in.

I was disappointed that the teachers' notes did not include adhesive lower case letters for the computers' keyboard. A number of the children were confused by the need to depress an upper case letter to produce a lower case one on the screen.

METRICS

The five programs in *Metrics* give practice in the vocabulary and structure of the metric system. Aimed at 10- to 15-year-olds, no teaching or discovery is involved, just a test of existing knowledge. For example, in Volume the user is asked 15 questions including:

Which is a metric unit of volume?
A. an exercise book
B. a box
C. a metre
D. a cubic metre

A further example from the Area program is:

The area of a farm field is measured in
A. metres
B. hectares
C. m squared
D. km squared

Other areas tested are length, capacity and mass. As in the *Angle* programs, a note of errors is displayed at the end of each quiz, but the teacher is unable to recall them for later discussion or analysis.

PASCAL

Pascal contains two programs that explain and test understanding of the properties of Pascal's triangle. Children who used it complained of it being slow and repetitious, with no interaction between them and the computer.

SEQUENCES

Sequences demonstrates seven number patterns, halving, Fibonacci, prime, square, and triangular numbers, and the multiples of 3 and 9. No interaction with the user is required, the programs just progress to the next stage, sometimes too quickly for the user to follow (eg the higher numbers in the Fibonacci sequence). Some colours, such as yellow on a green background, are scarcely visible and the sound effects seem quite unnecessary.

Like most of the other programs, they seem designed to 'lecture' the pupil rather than allow any interactive involvement. If, as is claimed, teachers are involved in the design of these programs, does this 'lecturing' approach represent their style of classroom management? All I can say is that it didn't suit the children in the two schools where I tried these programs.

We know the BBC micro is capable of great musical and graphics effects. However, when they are over-exploited, as they often are here, their ability to emphasise certain parts of programs is wasted.

Some of the initial ideas for these programs must have been very good, but I'm afraid their organisational approach and presentation were such that they are unlikely to be in demand in my school. We have teachers who can teach these subjects so much better, and have more valuable uses for our micros.

John Corder

John Corder is Head Teacher of Downsview Primary School, Croydon.

**From January to June 1983, *Acorn User* carried a series of articles on micros in primary schools, which recommences in this issue.
Subjects covered were: computers in the curriculum, school organisation, maths, programming, language development, and information technology. December's issue (1982) also explained Logo.
If there are any topics you feel need airing, or projects you would like to submit, write to:
Micros in Schools, Acorn User,
53 Bedford Square,
London WC1B 3DZ.**


MICROS IN SCHOOLS
8 PAGE PULL OUT
LANGUAGE DEVELOPMENT
Heather Govier outlines some exciting work on language programs for primary schoolchildren in the fifth part of our education series


SCHOOLS
it INFORMATION TECHNOLOGY
THE FUTURE FOR MICROS
The government clearly believes information technology is vital to Britain's industry. It will also play an increasingly large role in our lives and education. Tricia Strong and Paul McGee outline an IT course being developed in Croydon schools for the last in our six part series on micros in primary schools.

RESPONSE TO LANGUAGE AND IT ARTICLES

Dear Miss Govier,

I was fascinated by your article in the May edition of *Acorn User* and in particular, the program *Tray*. As an educational psychologist, I am particularly keen to explore the value of computer programs which excite children to use their existing knowledge and reasoning powers in a creative manner – a process which is likely to reinforce existing knowledge and extend understanding far more effectively than drill programming.

The article invites those interested in taking part in the serious evaluation of the programme to contact you, hence this letter. As you will appreciate, my interest is particularly geared to pupils with special needs. I already have a fair understanding of the issues involved in computer applications through my association with the Ormerod Special School here in Oxford, and the special needs department at the Wheatley Park Secondary School.

If this offer is of interest to you, I would welcome an opportunity to further explore the issues and to examine how best to implement an evaluation programme.

Roger Boulton
Senior Educational Psychologist
Ormerod School, Oxford

THERE has been a dramatic and almost overwhelming response to the series of articles in *Acorn User* on computers in schools.

The article on language development work, in particular, resulted in almost 100 letters to the Davidson Centre, Croydon, from schools and other institutions wishing to participate in trials of the program *Tray*.

From this number, a group of 30 teachers was selected and a meeting called at which the software was disseminated. After almost a term of use, feedback has been received from many of the teachers and most is very favourable.

It is clear that the articles have been widely read by teachers and have served to fill an urgent need.

Heather Govier

IN THE June issue of *Acorn User* an article appeared entitled 'Information technology: the future for micros', which suggested the need for a course in information technology with the upper junior/lower secondary age range. The article went on to describe the project which has been established in Croydon to develop written materials and software for just such a course. The article ended with an invitation to readers to act as trial schools for some of the draft materials the project has produced.

The response to this invitation was staggering. The project office has been inundated with requests for information and offers to trial materials. So far we have received 75 queries about the project from institutions all over the country and as far away as Dubai, New Zealand and Australia. After reading more about the project, 31 of these offered to trial materials, providing a comprehensive network of age ranges and situations.

Some queries were from higher and further education establishments intending to use the ideas put forward by the Croydon project, adapting them to suit their own students. Several writers mentioned that they too were designing IT courses for their schools and subsequent exchanges of correspondence have shown a strong similarity in development.

The fact that queries are still coming in to the office four months after the article appeared, and the similarity of course development going on all round the country at school level confirm the widespread feeling that such a course is needed. Obviously *Acorn User* has enabled many people previously working alone to gain support and confidence from communication with others with similar needs.

Trisha Strong
IT project director

Dear Mr McGee,

I am intending to visit the UK next year on study leave and am writing to you, in your role as the series consultant of the BBC 'Micros in schools' articles in *Acorn User*.

In our state, Tasmania, the education department has recently standardised on the BBC micro (in addition to our on-line network system in all secondary schools). Currently, nearly all primary and secondary schools have BBC micros and the state computer centre is actively writing software.

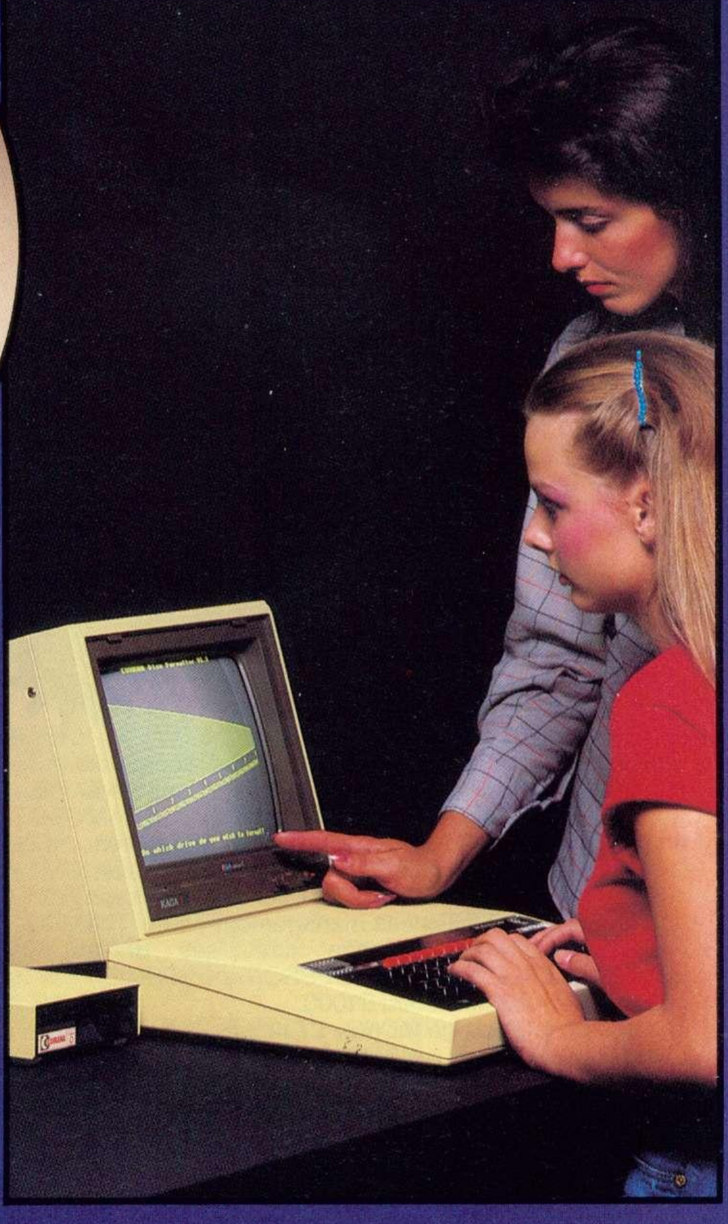
However, in my area, home economics (more particularly food and nutrition), there is a paucity of good software, which makes teaching for our students in their computer courses more difficult. Are you aware of any suitable software, and second do you know of any schools using, or intending to use computers in the home economics area? If so, could you let me know so I could write and perhaps visit them next year.

Bob Boocock
Tasmanian College of Advanced Education, Australia

Any schools or software houses who can help should write to *Acorn User* and we will pass the information on.

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Paul McGee aroused some strong feeling with his book reviews in July's issue. Here, two critics of his article get their say, and Paul replies.

REVIEWS

BOOKS
THE GOOD, THE BAD & THE PAP

Paul McGee takes a dozen off the shelves and examines their educational value

Sir, I would like to counter some of the criticism of Clive Prigmore's *30-Hour Basic* with at least a little praise. In *Acorn User* of July 1983, Paul McGee describes it as 'mind rotting pap' – a comment which is unfair, to say the least.

In early 1982, while waiting for the miraculous Beeb to materialise, I decided to brush up my Basic since I had not used the little knowledge I had for 14 years. I bought a copy of Prigmore's book and found it very useful: it taught me much I had never known and, in spite of the misprints and obscurities in the first edition, I would recommend it to anyone in the 'infant' stage of learning Basic when a diet of wholesome pap is appropriate.

However, I would agree that the book is a poor advert for BBC Basic, reflecting as it does the policy of promoting computer literacy, not merely one computer.

R Orton
Berks

Mr Orton and I agree that *30-Hour Basic* is a poor advert for BBC Basic. I do not object to infants being fed on pap. But I think that *30-Hour Basic* is mind rotting whereas he thinks it wholesome—but then he thinks the Beeb is miraculous whereas I think it is quite good.

Paul McGee

Sir, Paul McGee's review of my book *Microcomputers in Science Teaching* is inaccurate and misleading (July '83).

First, he describes it as a 'Basic programming book', which it manifestly is not. Of its 300-odd pages, less than 30 are about Basic and most of these are about the display of graphs, bar charts and diagrams.

My book is not about programming as such, but about using microcomputers to enhance science teaching, particularly physics. A teacher can only do this with adequate software, consequently most of the book is listings of programs specifically designed for the classroom. These include wave motion and interference, molecular motion, electron flow in conductors and semi-conductors and nearly a hundred others.

A whole chapter is devoted to interfacing the micro in the science laboratory and includes a full description and listing of my time, speed and acceleration program (which won a Commodore software competition in 1980).

Second, your reviewer describes my book as belonging to the 'teletype era'. The exact opposite is the case. The stated aim of the book is to show how graphics can replace the textual printout, common in early programs for computer-aided learning. Most of the listed programs rely heavily on graphics and many use machine code routines to achieve maximum effect. It is precisely *because* of its emphasis on graphics that the book is of little use to a BBC micro user; it is too Pet and Apple specific. However, a BBC micro version will be published shortly and readers will be able to judge for themselves whether it deserves the condemnation you have given the book.

R Sparkes
Stirlingshire

I agree with Mr Sparkes that my use of the term 'teletype era' is unfortunate. I was trying to say that the standard of program design had not left the teletype era, not that he failed to use graphics. Perhaps that is a criticism of Pet Basic, and it will be interesting to see whether the BBC version is any better in this respect.

In the preface to his book Mr Sparkes says: 'I do want to warn you that I am assuming a basic competence with . . . Basic. . . . The broad principles may be apparent, but the intimate details of how to get the microcomputer to behave in a particular way will not be understood. . . . I hope to assist other subject specialists to write their own programs. . . .' All of which seems to suggest that the book is more about how to program the Pet rather than about principles of using micros in science teaching.

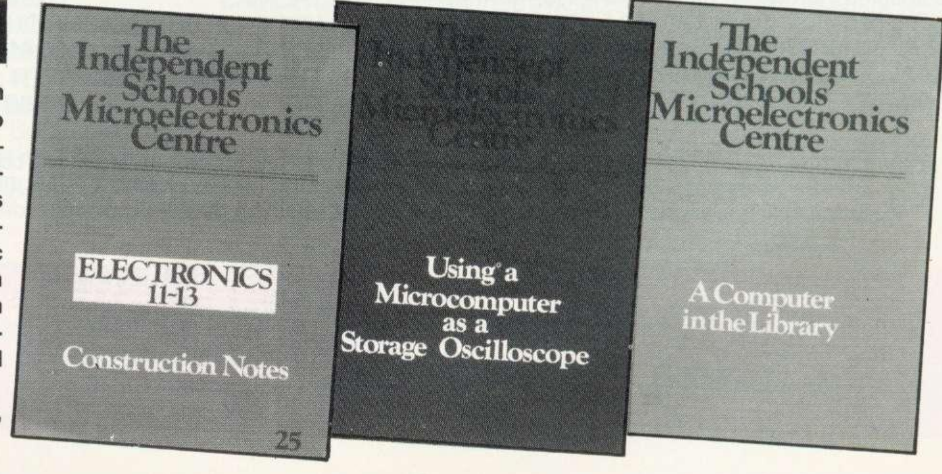
I have re-read the book and still agree with what I wrote.

Paul McGee

MICRO NOTES

A SERIES of booklets and information sheets on computers in relation to schools has been produced by ISMEC – the Independent School's Microelectronics Centre. Using the BBC micro as a storage oscilloscope (includes program listings) is the only Beeb-specific booklet. However, there are information sheets covering Basic II, linking to an RML 380Z, user port, external loudspeakers, logo, cassette recorders and other aspects of the BBC micro.

ISMEC is at Westminster College, North Hlncksey, Oxford OX2 9AT.



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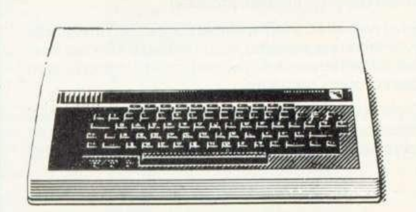


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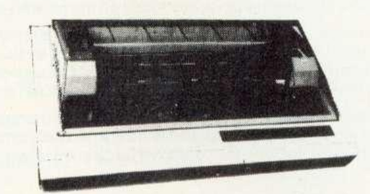
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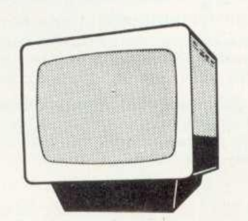
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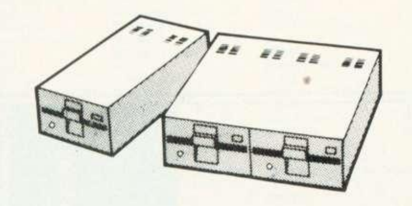
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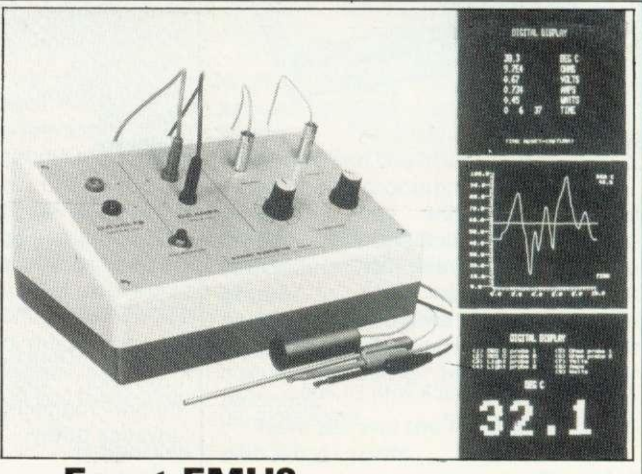
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USER GROUPS

☐ Are there any BBC users in **Sri Lanka**? If so, Mr Ananda Malalgoda would love to hear from you. His address is 36 Siripa Road, Colombo 5. Let us know if there is a User Group over there or if you form one.

☐ The **Sheffield** Acorn/BBC User Group (ABUG) has let us know that it holds both social and formal meeting on the first and third Wednesday in each month respectively. The group is on the lookout for up-to-date info on shows, demonstrations and lectures as well as hardware and software developments. New members can contact John Fryer at the address below.

☐ The **Stratford** Computer Club has been in existence for three months and already has a number of members—they would like more! The club meets monthly in the Wesley Hall and the main aims are to share and improve programming technique and to demonstrate and exchange software. They also produce a newsletter for members. The address and phone number are listed below.

☐ A small but rapidly growing BBC user group has been formed in South Manchester. Anyone wanting to join should contact Dave Davies at the address below.

☐ NEWBUG has just moved to larger premises in **Washington** Central Library and is on the lookout for new members. They meet every Tuesday from 7 to 10pm for fairly informal get-togethers. Children under 14 should be accompanied by an adult. You can contact Tony Pickard at the address below.

☐ A small group of Beeb owners in **Inverclyde** (Greenock, Port Glasgow, Gourock and Wemyss Bay) have started a club which meets on the third Monday of the month at the address given below. They look forward to hearing from potential members.

CLUB CONTACTS

● Rupert Steele
Amateur Computer Club
St John's College
Oxford OX1 3JP

● **Beebug**
374 Wandsworth Road
London SW8 4TE

● J Smith, Secretary
Brighton, Hove & District Computer Club
30 Leicester Villas
Hove
E. Sussex BN3 5SQ

● Dr Leo McLaughlin
North London BBC Micro Users Group
Dept of Chemistry
Westfield College
University of London
Kidderpore Avenue
London NW3 7ST
Tel: 01-435 0109

● **West Midlands Computer Group**
12 Apsley Road
Oldbury
West Midlands B68 0QZ

● Mr J. Price
Bedford House
27-28 St George's Road
Brighton
Sussex

● Mr P. Beverley
Norwich Area Acorn User Group
Room 12a, Norwich City College
Ipswich Road
Norwich NR2 2LJ

● Keith Mitchell
Edinburgh ZX Computer Club
19 Meadowplace Road
Edinburgh
Tel: 031-334 8483

● Steve White
Atom/BBC User Group
c/o Superior Systems Ltd
178 West Street
Sheffield
Tel: (0742) 755005

● Robin Bradbeer
Association of London Computer Clubs
Polytechnic of North London
Holloway
London N7 8DB

● Nik Kelly
Liverpool BBC & Atom Group
56 Queens Drive
Liverpool L4 6SH
Tel: 051-525 2934

● Andy Purkiss
Namebug
12 Palm Close
Witham, Essex.
Tel: 0376 515609

● I. Beng
BBC Micro Club
PO Box 1297
Santa Cruz de Tenerife
Tenerife

● Lindsay Thachuk
Beebnet
PO Box 262
Kingswood
South Australia 5062

● Richard Sterry
BBC Micro User Group
1 Wavell Garth
Sandal Wakefield
West Yorkshire WF2 6JP
Tel: Wakefield 255515

● Colin Price
Keighley Computer Club
Red Holt
Hainsworth Wood
Keighley
W. Yorks
Tel: Keighley 603133

● Jennifer Woeller
Sutton Library Computer Club
Sutton Central Library
St Nicholas Way
Sutton, Surrey
Tel: 01-661 5031

● Mr C. Rutter
Medway Atom Users Club
St John Fisher School
Ordnance Street
Chatham
Kent

● Mr J. Ashurst
Acorn Computer Users Group
Abraham Moss Centre
Crescent Road
Manchester 8

● Mr D. L. Evans
23 Hitchin Road
Henlow Camp
Bedfordshire

● N. P. (Bazyle) Butcher
Harrow Computer Group
16 St Peter's Close
Bushey Heath
Watford WD2 3LG

● R. Weich
Harpenden Microcomputer Group
7 Tylers
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● Mr P. Frost
Atom Users Group
3 Leyland Road
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Warks CV12 9LW

● Oivind Grenness
BBC Norway
O-Inform
PO Box 716
N3191 Horten
Norway

● R. V. Souter
TRS/80 Beeb Users Group
25 Carr Lane
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Hull HU10 6JP
Tel: 0482 654117

● E. R. Piper
Bognor Computer Group (BUG)
2 Ely Gardens
Aldwick Park
Bognor Regis
Sussex PO21 3RY

● Andrew Pike
Peterborough Personal Computer Club
920 Bourges Boulevard
Peterborough PE1 2AN
Tel: 0733 44342 (after 5pm)

● Dave Clare
Mid-Cheshire Computer Club
Providence House
222 Townfields Road
Winsford
Cheshire CW7 4AX
Tel: Winsford 51374

● **Liverpool BBC Microgroup**
c/o Fred Shaw
14 Albany Avenue
Eccleston Park
Prescot
Merseyside L34 2QW

● John Harris
Bottisham Acorn User Group
1 Rowan Close
Bottisham
Cambridge CB5 9BN
Tel: (0223) 811487

● Peter Smith
Fareham and Portchester Amateur Computer Club
23 Sandy Close
Petersfield
Hants

● Paul Barbour
Laserbug
10 Dawley Ride
Colnbrook
Slough
Berks SL3 0QH
Tel: 02812 3064

● Brian Pain
Colour Micro Users Group
40a High Street
Stony Stratford
Milton Keynes
Tel: (0908) 564271

● Mr D. Coulter
Preston BBC User Group
8 Briar Grove
Ingol
Preston PR2 3UR

● **Acorn Users Group of Sweden**
c/o Janne Soderberg
Frihetsvagen 32
S-175 33 Jarfalla
Sweden

● Peter Wilson
Universal Micro Club
26 North Cape Walk
Corby
Northants NN18 9DQ
Tel: Great Oakley 742622

● John Haigh
Iver Computer Society (IC's)
141 Leas Drive
Iver
Bucks SL0 9RP

● John Eary
Kinder Peak Computer Club
36 Parkway
New Mills
Tel: New Mills 43870

● C. Verrier
Wandsworth Computer Club
Earlsfield Library
Magdalen Road
London SW18

● Mr J. Craig
National BBC User Group
40 Mount Pleasant Avenue
Wells
Somerset BA5 2JQ

● Mr R. Luff
Kingbee
54 Arlington Close
Kingwinford
West Midlands

● **Computer Club**
Caterham Leisure Centre
Godstone Road
Caterham
Surrey CR3 6RE
Tel: Caterham 48304/43316

● Ted Ryan
Eastwood Town Microcomputer Club
15 Queens Square
Eastwood
Nottingham NG16 3BJ

● Mr T. A. Kayani
SOBAT Computer Club (East London)
12 Calderon Road
London E11 4EU
Tel: 01-556 5423

● Mr M. G. Forster
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8 St George's Avenue
High Lane
Tunstall
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Tel: 818499

● **Muse** (for teachers)
Freepost
Bromsgrove
Worcs B62 7BR

● Mr B. Carroll
The Cottage
42 Manor Road
Aldershot GU11 3DG

● Steve McLeod
BBC Users Group of Canberra
5 Hatfield Street
Evatt A.C.T. 2617
Australia
Tel: (062) 58 7719

● A. H. Fowler
Tonbridge School Computer Society
44 Birling Road
Tunbridge Wells
Kent TN2 5LY

● J. Assies, Secretary
Big Ben Club
PO Box 177
4670 AD Zevenbergen
The Netherlands

● H. W. H. Fisher
Sunningdale BBC User Group
82 Cedar Drive
Sunningdale
Berks SL5 0UB
Tel: Ascot 25030

● Peter Hughes
Format 40/80 Club
BBC Disc User Group
5 March Street
Bristol BS1 4AA

● Dave Davies
229 Manley Road
Chorlton-cum-Hardy
Manchester M21 1RB
Tel: 061-881 0382

● Tony Latham
Computer Users Club
69 Hadlow Road
Welling, Kent DA16 1AX

● Tony Pickard
Newcastle & Washington BBC User Group (NEWBUG)
c/o Washington Town Centre Library
The Galleries
Washington, Tyne & Wear
Tel: 091-417 3992 after 7pm

● John Fryer, Treasurer
ABUG
17 Edgedale Road
Sheffield S7 2BQ

● Chris Parry, Secretary
Stratford Computer Club
16 Sackville Close
Stratford-on-Avon
Tel: 0789 68080

● Robert Watt
Inverclyde BBC Micro Users' Club
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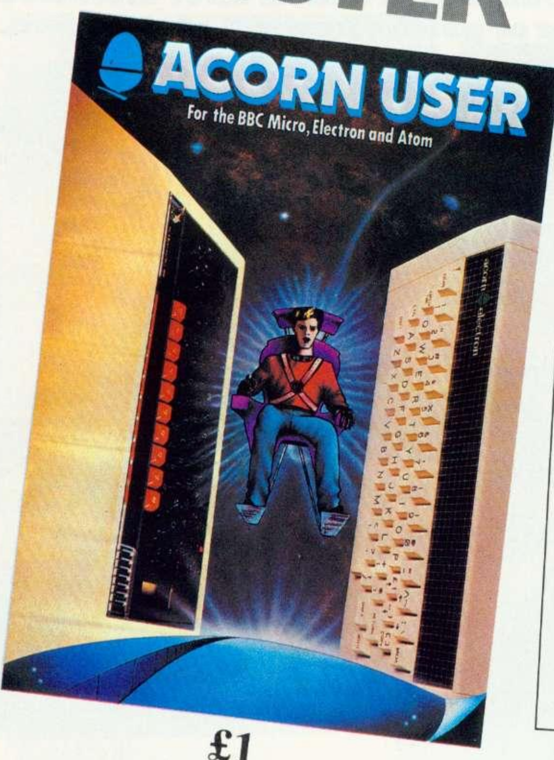
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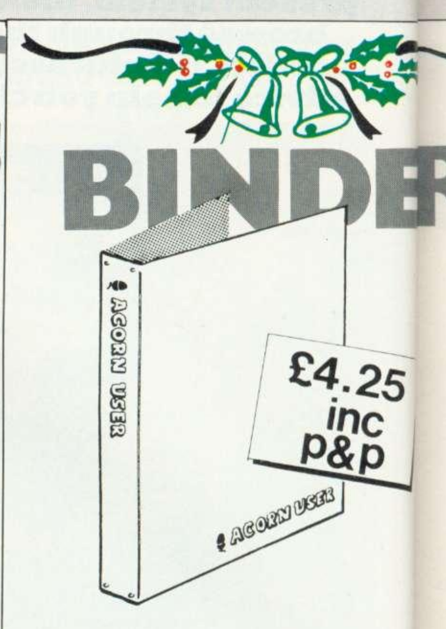
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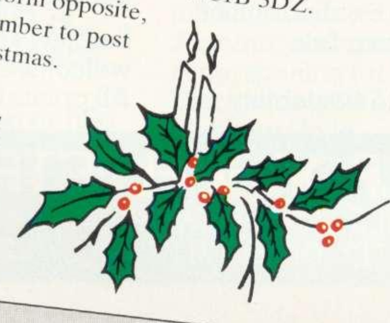
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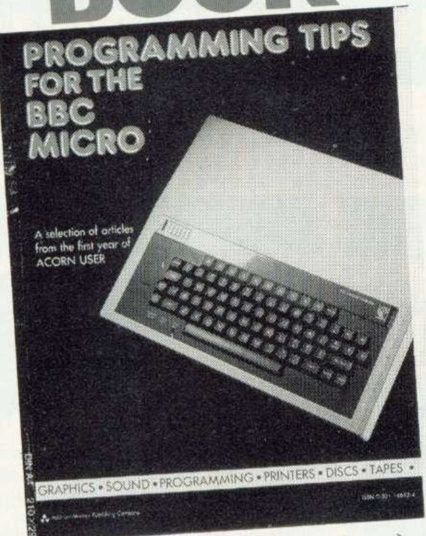


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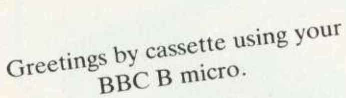


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I enclose a cheque for £.............. made payable to Addison-Wesley Publishers

Name ....

Address ....

....

....

Send to: Offers, Acorn User, 53 Bedford Square, London WB1B 3DZ.

ACORN USER OFFER
WORDWISE wordprocessing chip

Please send me.......Wordwise chips at £37.95 each, total £.......

Cheque payable to Computer Concepts

....

Name ....

Address ....

....

....

Send to: Offers, Acorn User, 53 Bedford Square, London WC1B 3DZ

ACORN USER OFFER EDSOFT COMPUTER CARD

Please send me.......cassette Christmas cards, total £.......
Cheques made out to Edsoft. My message is (up to 35 characters):

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

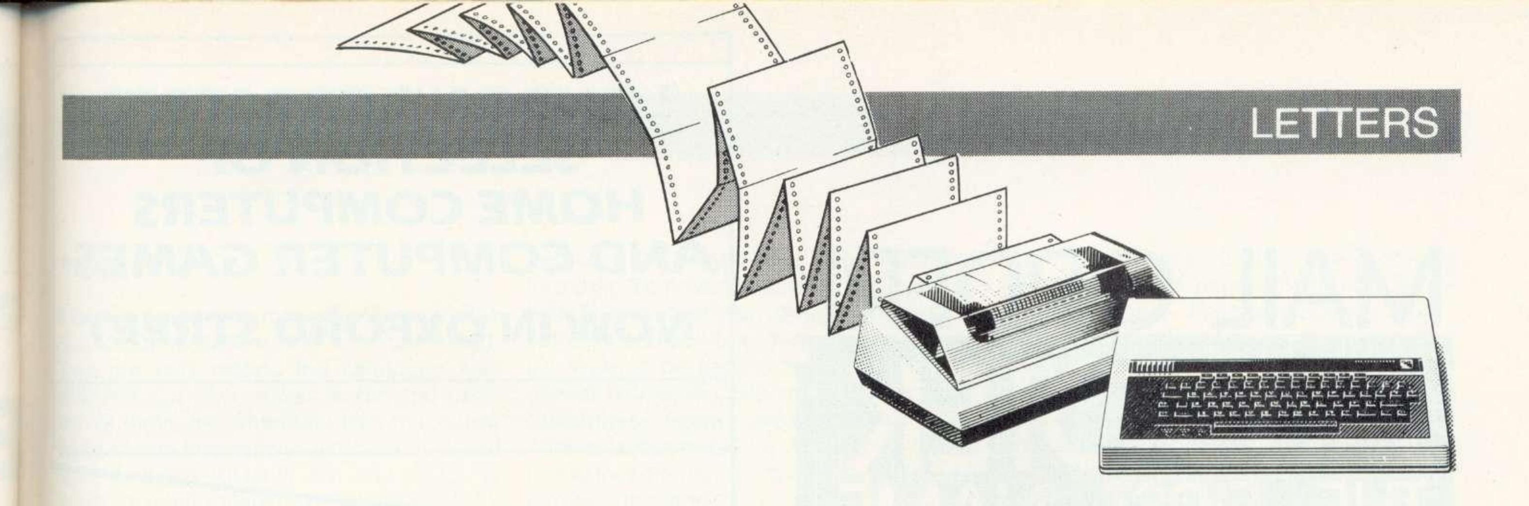
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Name ....

Address ....

....

Send to: Offers, Acorn User, 53 Bedford Square, London WC1B 3DZ.



BORING COMPUTERS?

Sir, I agree with you totally in your article 'Why the girls don't compute'. I was given a computer last Christmas at the age of 10, and was one of two girls my mum saw at the *Acorn User* Exhibition.

All my friends think computers are boring and that they go with all the other boys things, for example cars and electronics.

My father is an engineer and my mother is a scientist. I have never been channelled into girls' toys or boys' toys, but allowed to have what I was interested in. At the age of five I had an electric train set. My brother plays with Action Man dolls more than I have played with any type of doll. He is more into fantasy than I am.

Perhaps girls and women may prefer more factual software than fantasy software, whether it be adventure or space games. For instance;

- Books on tape that you can read off the VDU and it turns the page over for you.
- Details of hobbies.
- Ready calculation, multi design, knitting patterns.

Come on girls get computing.

Carina Moss (age 11)
Dartford

CRECHE ANSWER

Sir, I have just started to teach computer studies at Colchester adult education centre and in one class I have 13 ladies and one man and in the other 10 ladies and four men. Places are allocated as first-come, first-served and there is still a waiting list, so there is no shortage of keenness.

I was surprised therefore to read your article in the October *Acorn User* 'Why the girls don't compute'. Presumably my ladies are attracted to the courses because of their times; one course is 10am-noon (with a crèche available) and the other 1-2.45pm, leaving time to pick up children from school.

Perhaps if more adult education centres with the necessary facilities were encouraged to provide courses in computer studies during the day it might have an effect on women's attitudes. After all, if mum is learning computing it must be a girl's subject.

Carol Hart
Colchester

FORGET IT!

Sir, May I point out that patronising comments such as: 'When will the women step forward to tell the *men* what they want?' (Editorial October 1983) are hardly likely to fill 'bored housewives' with enthusiasm for Acorn computers.

If this is a typical example of your attempts to bring sexual equality into the computer world forget it!

Belinda Wardle
Leeds

DFS REPLY

Sir, Mr Moody's point (*Acorn User*, November) on the shortage, earlier this year, of BBC micros with disc interface is well understood and resulted from a higher than expected demand.

The concern remains over a customer receiving a non-authorised DFS version which cannot be guaranteed to work in conjunction with other Acorn filing systems. Currently 0.90 DFS is the only version which has been tested in this respect. Customers should ensure, as far as possible, that they are sold a genuine Acorn product and we would welcome information in any doubtful areas.

David Bell
BBC Project Manager
Acorn Computers

TELETEXT TIPS

Sir, I received my Teletext adapter in October (ordered April/May 1982). My natural exasperation with this incredible and badly warned delay, dominated and soured my thinking about telesoftware.

However, I have to admit that this attitude has fast eroded because of the fine performance of the system. Indeed, I find the reliability when downloading programs superb, and markedly superior to Prestel.

I would like to pass on the following simple tips to new users. First, as a routine, check the tuning (SHIFT/f4) say once a week, as a precaution against drift.

Second, be patient when all you have is a screenful of 'Searching. . .' messages, especially if you are downloading an 'ordered' program. The computer must wait for the right sequence of the continuing TV broadcast and it can sometimes take two or three minutes. I have never had a failure of downloading in this respect, except when I at first wrongly disbelieved the long list of 'Searching. . .' messages. Trust the computer!

Finally, do not leave the adapter power switch on when leaving TFS for loading long disc programs. Don't forget that when in DFS, with adapter power on, PAGE will be, not &E00, not &1900, but &2400!

I would welcome comments on the pros and cons in having TFS rather than DFS as the default filing system.

Ernest Cummins
Blackburn

57 VARIETIES

Sir, Following the comments from Robin Newman (November) concerning my article on disc files (October), I have written a couple of modifications to the main program.

The first overcomes the problem of 'ALT' always defaulting to the drive the disc in use was created on. This problem meant that if you had created a dual catalogue disc on drive 0, and then tried to switch catalogues whilst this disc was in drive 1, 'ALT' will load from this disc but will perform the switch on drive 0.

The next few lines, typed after loading the main creation program, will make sure 'ALT' performs the switch on the correct disc.

```
640 LDA #111
642 JSR &FFF4
644 STX INST
```

This procedure uses OSBYTE with A=111 which returns, in the X register, the number of the last disc drive accessed.

The second modification removes the direct memory access in line 130 and replaces it with a routine (using the command line interpreter) that should be compatible with any existing, or future disc filing system. As above, after loading the main program type in the following few lines:

```
130 DIM X% 10
132 $X%="DRIVE"+STR$(DRV)
134 Y%=X% DIV256
136 CALL &FFF7
```

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▶ page 157

It is also possible to make the 'dummy' files (Z.Z Z.ZZ) invisible to the *CAT command. This not only makes the catalogue less cluttered but also makes accidental deletion of these two important files much less likely. To do this change any occurrence of 'Z.Z' to '[shift f0].[shift f0]' and 'Z.ZZ' to '[shift f0].[shift f0][shift f0]', where [shift f0] means hold down the shift key, and at the same time press f0. This procedure works fine with Acorn's DFS but will not work with Watford's as control codes cannot be used in file names.

Nigel Pendleton
Rugby

HOME TRUTHS ON THE ATOM

Dear Reader,
At the risk of treading on a few toes, I feel it is time for some home truths. Since I am an unashamed Atom fan, and not directly employed by *Acorn User*, I hope I can be considered sufficiently unbiased for my comments to have some merit.

First, the question of Atom coverage in this magazine. It is estimated that the readership (for 1983) is in the ratio of 9:1, in favour of the BBC micro (and Electron) – and this is likely to rise, as Electrons appear. In the November issue, there were $7\frac{1}{2}$ editorial pages devoted exclusively to the Atom, 24 exclusively to the Beeb and the rest being of general interest. Thus, 45 pages could interest Beeb readers and 29 Atom readers – a ratio of just over $1\frac{1}{2}$:1. Taken purely on the basis of 'Atom only' pages, the ratio is 7:1 – still more than is justified by the readership. That this is so is thanks to the Editor, who, like myself, would be sad to see the Atom fade away. However, it is misleading to look only at those pages headed 'Atom' for within the other pages are a number of articles which, although written for the Beeb, are of value to Atom users – they just require a little more thought in implementation. This, really, is the answer to the point raised by Andrew Ward, in the November letters page.

In the same issue was a letter from M Collins of Chelmsford and I will attempt to answer this. Yes, the Atom is obsolete. Chip technology has moved a long way since it was designed – but obsolete is not the same as useless. At the risk of repeating what I said in the October issue, the Atom is fast, extremely versatile and won't be useless, by present standards, for many years to come. Has Mr Collins been conned? On balance, I feel he has. Things grind exceeding slow in company affairs and Acorn's decision to cease production in February 1983 must have been taken before that. To advertise a machine as being built to last, a proven design, with lots of software and add-ons, gives the impression it's likely to be around for some time. To cancel production two months later (and, remember, Acorn used the misleading phrase 'support for the Atom' in its public pronouncements), is, to put it mildly, not playing the game.

I don't accept the Editor's analogy with a new model car or washing machine. In these fields, technology moves more slowly and, as often as not, 'this year's model' is last year's in a new case. The differences are minor and they all do much the same things in similar ways. Not so with computers. However, I can think of a valid analogy.

Many years ago, the making of the one-millionth Morris Minor car was celebrated amidst a fanfare of publicity. Then came the one-millionth Mini, and more celebrations, followed shortly after by the dropping of the Minor. However, the Minor was a much-loved motor: it was reliable and easy to maintain. You still see 'Moggie Minors' around in fair numbers. They don't do 50 to the gallon, you don't see many in the fast lane and they don't talk! The owners don't care, however, because the car does what they want. When BL stopped making the spares (10 years after production ceased) the owners club formed their own organisation for second-hand spares. Get the point?

Nowadays, the millionth car goes by unnoticed. It's all a question of scale – and this, presumably, is Acorn's viewpoint. If you can sell, as they hope to do, 60,000 Electrons by Christmas, then selling 100 Atoms a month becomes frivolous. Note, however, that Sinclair took a different view. When sales of the ZX81 dropped, they just cut the price until it found its own level – and it's still in the 'Top 20' charts. Now why didn't Acorn do that? Selling a colour Atom at £90 would have found a ready market, albeit at minimal profit to Acorn (but then Sinclair can't be making much on the ZX81).

Presumably, Acorn didn't feel it was worth the effort! And this is where you feel cheated because, as Mr Collins points out, without the Atom sales, The Beeb could never have seen the light of day.

Is this any reason to rush, lemming-like, to get rid of your Atoms, as a whole pageful of you did in the free advert section of November's issue? I think not, and you should ask yourself the following questions, before writing out that advert.

Do you honestly expect to get the asking price? For £100, you can buy a new 5+8k Atom, with colour boards, and a London dealer sells second-hand Atoms at £50 (fully expanded). Ah, you say, what about the software? But is yours all original, in the maker's packaging? If it's copied, you are breaking the law for, whether or not copying may be illegal, *selling* copied software certainly is. At best, you might expect to get £75.

In November's issue, one software house had a full page advert, exclusively for Atom users. Full-page adverts cost – and it takes a lot of tapes to recover that cost. If they don't sell the makers stop selling for that machine – it's as simple as that. If *you* can't support your machine, how can you expect others to? And what do you do when the same thing happens to your replacement machine (as it eventually will) If you do the same thing, you are losing, hands down, all the time! Think about it.

This is positively my last word on the subject. The rest is up to you, but don't whinge about the situation, unless you're prepared to do something positive about it.

Finally, my thanks to the Editor, for allowing the space for me to let off steam.

Barry Pickles
Manchester

FAN MAIL

Sir, Would you also please convey to Mr Dally my thanks and appreciation for his competitions which have:

- given me a great deal of trouble and enjoyment in trying to plumb their depths.
- taken up more of my employer's time than he would approve of.
- been rapidly converting me into a 'Barmy Tree'. (A 'Tree' is a totally stationary being, but a 'Nutty tree' doesn't know whether it is coming or going!)

I await the next competition with eagerness and considerable trepidation.

F Dashwood
Edinburgh

SINGLE FILE

Sir, Using a disc-driven model B, I have set up a file inex on a suitable database to sort, modify and print. I input the new files in my own numerical order in batches of 70 to any one file name. Hence, cases 1 to 70 are on A file, 71 to 140 on B file and so on.

While this gives me the facility of putting the whole index on one disc, the major disadvantage is in having to reload a new file if I wish to access separately A file for case number 50 and thereafter B file for case number 75, etc.

Bearing in mind that the index runs to 1,000 cases, is it possible to delete the file names of separate blocks, A file, B file etc, so all files are compacted in numeric sequence on one disc with one file name and then to have access to any one case?

A. Knight
Hertfordshire

Unfortunately, the files may only be concatenated by creating a new file and reading in data from file A, pushing it out to a new file, reading data from file B, pushing it out, etc.

*CATASTROPHE

Sir, I am using a Tandy CTR80 cassette recorder and lead (rewired to the Beeb's DIN plug specification) with my 32k model A.

Each time I *CAT a tape with the cassette motor plug inserted into the 'remote' socket on the recorder, the on-off clicks of the cassette motor relay appear to record on top of the programs (which does them no good at all). I lost several programs this way before realising that the problem was after listening to the tape.

*CAT with the plug disconnected eliminates the problem completely, of course! Is this caused by the recorder, lead, or both?

A Wembridge
Rainham

Difficult to say for definite. It's probably the recorder at fault—but it may also be the lead. Suggest you get the lot looked at.

SORTING THEM OUT

Sir, In the October 1983 edition of *Acorn User* you published a letter by Robin Tracy in Ian Birnbaum's Forum which described the Quicksort as 'the most impressive method' for sorting data. I would like to make a few comments about this technique in comparison with other sorting methods.

First, the 'best case' operation of the Quicksort is indeed very good. On average the time taken to sort n data items is proportional to n logn, which is faster than any other technique for large n. However, it has very bad 'worst case' operation. This can be as bad as being proportional to n^2 for n data items. What is more, this occurs when the data is already in largely the correct order. The Shell sort or diminished increment sort, however, has far better worse case performance, always being less than proportional to $n^{3/2}$. Also it has very good performance for ordered data. The analysis of the Shell sort is much harder than the Quicksort, but empirically, for increments of 2^K-1, it can be shown the time taken is about proportional to $1.22n^{1.26}$.

The second point is one which many people do not take into consideration when designing algorithms. The Shell sort routine is quite a lengthy one and takes up much memory compared with the Quicksort. However, the Quicksort again has 'worst case' problems as it is recursive. If memory is at a premium, it may be necessary to sacrifice speed to get the data into the machine, and there many be no room left for stacking local variables during a sort of large quantities of data.

Finally, the Quicksort makes extensive use of random access, two areas of the data being compared at once. This is fine if data is in RAM, but when sorting disc files, the use of random access will greatly slow down the operation. In many cases a simple insertion sort may be much faster as data is accessed serially.

In short, as many programmers and mathematicians have stated, there is no such thing as the best sorting algorithm. The algorithm must be picked to be good in a particular instance.

For those interested in this subject, the classic text remains 'Sorting and Searching', volume 3 of Donald Knuth's *The Art of Computer Programming*, published by Addison-Wesley. Although the text is not advisable for the beginner it is a must for any serious programmer.

Mark Simms
Bristol

INNOCENT OS

Sir, I am writing this letter to find out if any other *Acorn User* readers have had the same problems as me with the new 1.2 operating system.

On inserting the new chip as per instructions, everything appeared fine, the computer switched on and all the extra features were tested and found to work. However, on testing the printout facility I found that, particularly when listing programs, garbage appeared on the paper.

On reinserting the 0.1 chip the printout facility was restored. I have now returned the 1.2 ROM for replacement and am eagerly awaiting this. I am interested to see if my faulty chip was the only one or have other people had similar experiences.

S Giergiel
Zimbabwe

The lads at Acorn reckoned it couldn't be the OS ('no way' they said), and proceeded to blame the printer. Bets were taken on it being an Epson MX80 working on RS423 at 9600 baud. If this isn't so, check the link settings given in July's Acorn User on page 97.

MODEM METHODS

Sir, I am studying A-level design and technology at college and as an exam project I have chosen to make a modem for a BBC model B (1.2 0S).

I am finding it difficult to write necessary software for the modem to function with the BBC. Could you please help. I would be grateful for any information.

Edward Boynton
Middlesbrough

An 'RS423 Application Note' is available free from Acorn Customer Services at Cherry Hinton, Cambridge.

There is also a group which runs an electronic bulletin board called Forum 80 which can provide terminal software. The man in charge is Frederick Brown at 421 Endike Lane, Hull HU6 8AG.

SIDE-WISE

Sir, After recently buying an EPROM programmer that will program 4k and 16k chips suitable for the BBC micro, I find I am having a singular lack of success when trying to use the newly programmed EPROMs with my BBC model B.

Do you or any of my fellow subscribers know the hardware/software mechanisms via which the paged ROM/EPROM feature of the BBC works?

The machine that the EPROM programmer is fitted to has a 1.2 operating system, although I would also like to program EPROMs suitable for the 0.1 version if there are differences.

Keith Watson
Canterbury

It's impossible to diagnose your problem, but Acorn does publish two booklets on the subject which may be of help. 'Sideways ROMs' (machine code programs) and the 'ROM Filing System' (Basic programs) are available for £2.50 each (cash with order) from Acorn cash sales at Fulbourn Rd, Cherry Hinton, Cambridge.

Also the 0.1 operating system does *not* support sideways ROMs.

CHARACTERS

Sir, Alexander Selby's hint for inserting characters into the keyboard buffer on a 0.1 machine (August) is very interesting, but the same can be achieved using *FX141. Hence *FX141,0,65 will put the letter 'A' (ASCII 65) into the buffer.

Note that on 1.2 machines, *FX138 is used instead, since *FX141=*ROM.

Ian Tresman
Herts

TURN-OFF

Sir, Our BBC B micro has just blown a chip – apparently as a result of my unplugging one recorder and plugging into another to compare them.

I did this without switching off the computer first, because I understand (rightly or wrongly) that one should not switch on and off over a short interval.

I would be grateful therefore for any information or advice to ensure that the trouble is not repeated.

Edwin Spencer
Seaton, Devon

However quick the process, the machine should *always* be turned off when plugging/unplugging a device which makes electrical contact.

Static electricity can also cause this problem, especially in dry atmospheres with certain types of carpet.

COMPARING NOTES

Sir, I use the BBC micro extensively in nearly all my school music lessons. In my view, most available software, although impressive, has little educational value in the classroom and I have therefore developed several programs of my own. I would be pleased to hear from any reader in a similar position in order to compare notes and hope that, with your help, those interested can be contacted.

Secondly, could I also seek some technical advice, regarding the RND (random) feature of the BBC micro Is there a way of achieving a (10 number) random output between 1 and 10 *without* duplicating any numbers? Many thanks, in anticipation.

John O'Brien
Flowery Field High School
Hyde, Cheshire

The random generator cannot produce such 'perfect' sequences unaided. It is, however, possible to write machine code programs to do this (see *PCW*, which ran machine code articles on random generation). Otherwise it can't be done.

There is a user group for music in education called TIME. Joe Telford can provide information from CECC, Prissick Base, Middlesbrough, Cleveland TS4 3RZ.

VARIABLE CARE

Sir, In answer to the question posed in the letter from Mr Johnson in the October issue, it is possible to redimension array variables but you must do it with care since it involves manipulation of zero page RAM.

Basic stores the locations of its non-resident variables on page 4 in RAM. It uses two bytes for each letter of the alphabet. You can calculate which you need using A%=&400+2*ASC("V"), where V is the first letter of your variable name. The computer will forget about *all* variables with names starting with V if you execute ?A%=0 : A%?1=0. You could now redimension V as normal, but you would soon run out of memory if you did it too often.

To overcome this problem you can trick Basic into using the same area of memory as before. But your second dimension must be no larger than the first or you may overwrite other variables. And you should use no other variable names with the same first letter (except residents).

The top of variables pointer 'VARTOP' is stored in locations 2 and 3 on zero page. This gives the RAM address where a new variable is normally stored and it is updated every time you define a new variable. Changing VARTOP to the address of your old array (stored in A% and A%+1) will result in the next variable defined being stored in the same place. You should then restore VARTOP to its old value so that you don't confuse Basic. The easiest way to store and replace VARTOP is to use !0. 0 and 1 contain LOMEN which will not change unless you edit your program, while 4 and 5 contain the Basic stack pointer, which must not be tampered with so we can't use !2.

The following program summarises the process for redefining array A.

```
10 REM—Redimensioning arrays
20 REM—The first dimension must be
the largest used
30 REM—Use no other variable names
beginning with A (except A%)
40
50 DIM A(100) : REM—Initial dimension
60 V%=!0      : REM—Store VARTOP
70 A%=&400+2 *ASC ("A")
              : REM—Location of
                array start address
80 ?2=?A%:?3=A%?1
              : REM—Reset VARTOP
90 ?A%=0: A?1=0
              : REM—Clear A (Y)
100 DIM A(90) : REM—Redimension
110 !0=V%     : REM—Restore VARTOP
```

You can determine the free space above your variables using PRINT ~ HIMEM−(!2 AND &FFFF)

And by altering VARTOP you can store your variables anywhere in RAM; ?2=0 : ?3=9 will use the RS423 buffer, a very handy facility if you are short of memory. But beware, your data will soon overrun the function key buffer and will eventually reach the start of your program. But Basic will be quite happy if you dimension a few variables there then restore VARTOP to its old value.

J Taylor
Leeds

'CAN'T EXTEND'

Sir, I have tried both Acorn and CUC DFS on a model B, and find that if I try to add to more than one file I get the 'Can't extend' message sooner or later.

This is a fatal shortcoming for business programming, and I would like to know if there is any practical remedy (swapping filenames, and so on only wastes time and disc life).

Am I stuck with waiting for the Z80 card and C/PM DOS, which has the facility to generate pointers, so avoiding the need for contiguous files?

If my worst fears are true, when will the Z80 card and C/PM DOS be available?

Jim Price
Brighton

'Can't extend' can be avoided by *COMPACTing the disc before opening the data file, or better – if you have dual drives – by using a separate disc for your data files. The DFS would use more space on the disc, thus allowing you to run out of space on the disc instead.

PLANETOID CLAIM

Sir, During the summer my brother bought the Acornsoft game *Planetoid*. I found the game difficult at first but soon I increased my high-score to 92,650. Could you ask your readers to write in and say what the records are on *Planetoid*?

Charles Painter (age 12)
Wiltshire

AFTER ACORNS

Sir, I have achieved a score of 183,390 on Acornsoft's *Snapper*. I managed to reach sheet 16 (three acorns). Can you tell me what happens after the fourth acorn sheet? In your December letters section, you said the record score was 180,000. Is my score a new record?

Julie Crawford
Blackburn

It sounds as if you should move on to another game! *Snapper* stays with acorns, and the speed and difficulty remains the same after this. Your score was the highest we'd been informed of, but see below.

On to another game, *Starship Command* (the Editor's favourite). Several people have asked how many different ships there are, and the answer is eight. After that, the shapes repeat.

Look out in future issues for our own software charts and analysis of the market.

RECORD SNAPPED?

Sir, I have scored 245,100 on *Snapper*. This is the sixth time I have scored more than 200,000 and I was wondering if this is the highest known score. Mum and Dad were both witnesses.

Roger Lewin (aged 12)
Frome

Sir, I was recently playing Acornsoft's *Snapper* and I found two bugs. As I was about to eat the last ghost, it went into the tunnel, so I went in the other way. When I ate the ghost, it was in the part of the tunnel you cannot see. Then, its eyes made a hole in the wall and it got stuck there.

The next bug I found was that when I ate a ghost at exactly the same time as I ate the last dot, four or five high-pitched notes sounded.

K Heal
Suffolk

You've obviously got an early version of *Snapper*. These bugs were sorted out when Acornsoft reworked the format of *Snapper*.

SOUND ADVICE

Sir, Further to the article in *Acorn User*, I eagerly tried out J Doggett's sound modulator idea, which works very well indeed.

As he points out, the link-capacitor requires a trial and error approach but I found that 150pF worked best. Additionally, by removing the lid off the sound modulator and adjusting the core of the tuning coil (very carefully and only by a small amount) the quality of sound reproduction can, in some instances, be slightly improved. Adjustment of the resident video modulator should not be attempted, unless one has the correct equipment and expertise, since this could adversely affect picture quality.

May I thank J Doggett and *Acorn User* for another very useful article, which concludes satisfactorily my quest to achieve good quality sound, at the *user's* desired volume, from a BBC micro.

B Sharrock
Bolton

TINY BOPPER

Sir, My 11-month-old daughter discovered an undocumented feature of the 1.2 operating system while playing with the computer. She was hitting the keyboard with random abandon when I discovered that lower-case characters appeared as the shift key was pressed. There is a new mode of keyboard operation in OS 1.2 which is entered after shift/caps-lock are simultaneously pressed.

The new (shift/caps-lock) mode gives the upper-case characters as usual, but when the shift key is depressed, lower-case characters can be obtained. This can be useful when entering program, with variable names in lower-case.

Does my daughter hold the record for the youngest contributor?

Martin Glass
Truro

We're certainly not going to argue with an 11-year-old!

RAM JAM

Sir, I recently bought a new BBC micro with the 1.2 operating system and am highly delighted with it. However, I have found one snag which I can't debug. When typing in a program which contains the variable I% for example, the error 'No such variable' is generated.

This happened again when typing in program 3 from the graphics article in your May issue. On changing the variable to S% the program ran.

Again, I have typed in program 5 which contains variables C1% and C2% in line 160. This generated 'No such variable at line 160'. I retyped the program in at a later time and it ran OK. I'm sure there was no typing mistake the first time.

Is there some bug in the keyboard or OS?

W Caley
London

First of all, make certain these haven't been typing mistakes by using a very simple program (preferably checked on another machine).

If it still happens, you probably have a RAM fault which a dealer can check.

PRIMITIVE URGE

Sir, I am planning to use a BBC machine in data logging applications. For this I wish to have a tape running continuously and to output strings of about half a dozen characters up to, say, 10 times per second.

To do this I need to bypass the tape filing system, but so far I have not been able to locate either the appropriate OS routines or to find out the codes necessary to control the serial output chip and ULA directly.

The primitives I think I have to construct are: switch on modulator; load character; transmit character; switch off modulator. Plus similar commands to read back and process the data. Will each group of characters require a synchronising character at the head? Can you give me any information on this problem?

T Smith
Felixstowe

Acorn 'is unable to supply this information', but perhaps a reader can. Any suggestions will be passed on.

JUMPING ALIENS

Sir, I own a BBC model B which I am using with a black and white portable TV.

When doing a paged listing or playing games such as *Arcadians*, the picture jumps all over the screen, to such an extent that it is unreadable. The problem with listings occurs once the page has been produced and the micro is waiting for a further depression of the shift key. The problem with *Arcadians* occurs when sound is emitted from the micro.

The problem doesn't occur when using the family colour television. Any light you could throw on to this problem would be greatly appreciated.

Brian Hodgson
Preston

The problem is obviously the TV, and apart from suggesting that you play with the horizontal and vertical hold, there's little we can recommend. Any ideas, readers?

TVs vary so much between models, it's difficult to make general comments.

MISGUIDED

Sir, I own an early BBC B upgraded to OS 1.2 and disc interface. On attempting to access a random access file using the OSFIND call with A set to &C0, I was expecting the channel number allocated to the file to be returned in Y. This is as stated in both the *Disc System User Guide* on page 70 and the *User Guide* on page 453. However, after several 'channel number' errors I found that the channel number is apparently returned in A. X and Y are both preserved giving the low and high byte address of the location containing the file name.

I note that OSARGS, OSBGET and OSBPUT all require the channel number to be in Y. Having been disheartened once, and having no need yet, I have not tried these calls.

Could there be an error in both guides, or have I got something hopelessly wrong?

C Deacon
Royal Electrical and
Mechanical Engineers

You're right in fact. There's an error in both books. The handle is returned in A by OSFIND, all the others require a handle in Y, as you say.

CHIPS WERE DOWN

Sir, I have read numerous complaints about the poor service received from computer manufacturers and dealers. I therefore thought readers would be interested to know about the excellent service I have received from my Acorn dealer, the Daventry Computer Centre.

When I bought my micro I discovered I had the 0.1 OS and several errors occurred while loading programs. So I phoned the dealer and was told they would let me know when the new MOS was available. This they did, and my exchange chip was fitted two days after arrival. A couple of days later I experienced a loading error: nothing would load at all so again I gave the shop a call. 'Bring it in', they said. So I did and the computer was checked with an oscilloscope. One of the chips in the cassette interface section of the board had blown so they sorted it out for me, while I waited. The machine has been fine since.

BBC owners with OS 1.2 may be interested to know of a bug in the system – the machine operating system command *FX3 does not work.

C Rain
Warwickshire

Nice to hear some good news. As for *FX3, see September's issue (page 95) for an explanation.

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COLOUR monitor for BBC micro, medium resolution (price today £350+), including fittings, £220. Phone Warrington (0925) 54626.

MAGAZINES. Two Sinclair Users, 11 Your Computers. All in excellent condition. 35p each or £3.50 the lot. Buyer collects. Phone Martin, Iver (0753) 653921.

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ATOM software to swap. Phone Llandeilo (0558) 823403 for details, after 5pm, weekdays only.

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SWAP? I have much software. Want new Acornsoft and any others. Not keen on Adventures. Good joysticks wanted. Discs with software also wanted. Like magazine back issues, good condition. Phone Greg, 041-639 7850.

PROGRAM POWER. Atom colour board £15. Mr M. R. Forrest. Tel: 065671 4613 after 7pm.

MK14. Science of Cambridge micro. Anyone still running this machine and interested in interfacing to BBC machine, etc, contact Alan Pickard, 14 Far Lash, Burbage, Hinckley, Leicestershire LE10 2PJ. Tel: 0455 39265.

ATOM 12k, 4 books, 3 cassettes, games, listings, leads and powerpack. Less than 12 months old, £150. Also Sinclair ZX81 Martian Knockout etc. No 5 Super Programs cassette, £2. Phone Dudley (0384) 235904.

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HAS anyone converted Sony KV1400 colour TV to RGB input? Will pay for details. Tel: (08926) 62540 evenings.

MAGAZINE back issues for sale. Personal Computing Today, Volume 1, Number 1 to Volume 1 Number 10. 60p each or £5 the lot (£8 including binder). R. Arundale, 27 Buckstone Road, Alwoodley, Leeds LS17 5HT.

TANDY TRS-80 Model 1, level 2 micro, 16k, sound, amplifier, new cassette recorder (worth £40), manuals, books, £50 worth software, all cables, £150 ono, vgc, original packaging. B. Stedman. Tel: Wimborne (0202) 881447.

BBC Software: Zombies, 3D, Bomb Alley, Centipede, Monsters, Missile Base, Planetoid, Zany Kong, Snapper, Gunsmoke, Business games, Road Runner, Rocket Raid, Philosopher's Quest, Magic Garden and Space Warp, £3 each. Phone: 01-500 5755 after 5pm.

ZX81, Memotech 16k RAM, Filesixty keyboard, ZX printer and ten cassettes, including VU-File, VU-Calc, Toolkit and Adventure games. Purchased December 1982, excellent condition, £50. BBC micro forces sale. Tel: Cley (0263) 740225.

BBC Model B, 1.2OS Basic 2, Acorn DFS BCPL View plus software. 400k double-sided Teac disc drive plus floppy discs. Includes boxes and books, £800 ono. Tel: 0245 58863 after 7pm.

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ZX81 software—Winged Avenger, Super Scramble, Pilot, £3.50 each. Volcanic Dungeon, Catacombs, Fantasy Games, X-Men, Avenger, Tomb, Dracula, £3 each. Gulp, Krazy Kong, QS-Asteroids, Arcade Action, £2 each. K. Chan, 9 Cornmarket, Thame, Oxon OX9 3DX.

AMERICAN personal computing magazines. Three for £4, or four for £5. Postage included. Wanted: Acorn User, Oct '82 to March '83. G. Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

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BBC tape program copier, back-ups/multiple copies. Deals with most/all protection techniques. M/code. Only £4. SAE details, other programs. Mr S. Law, 105 Gill Bent Road, Cheadle Hulme, Stockport, Cheshire SK8 6NM.

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PACE Amcom DFS with disc & manual for sale at £24. Also Beebcalc with manual at £25. Both only fitted for testing after purchase. Tel: 061-439 9768 after 6pm.

COMPUTER and electronics magazines for sale, Personal Computer World, Personal Computer News, Hobby Electronics, Practical Electronics, Everyday Electronics. Ring for details. Simon Bale, High Wycombe 712982 after 5pm.

BBC B disc interface, Wordwise, 1.2 ROM, £475 ono. Acorn Teletext adaptor, brand new, beat the queue, £250 ono. Disc interface £75. 30 hour Basic book £3.50. Prism Acoustic modem with Prestel software, £55 ono. Tel: Canterbury 750600.

BBC teletext adaptor (unused), Acorn AP100A printer including Parer and label paper. Also masses of software for sale or swaps and many unused computer blank tapes (40p). Tel: (02576) 3271 after 6pm.

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DUST COVER for BBC micro made of cream canvas—very strong, unused, £2 from Maria Jewsbury, 45 Rowley Lane, Lepton, Huddersfield, Yorkshire. Tel: 0484 22288.

BBC cassettes: games of strategy. BBC Octuplet (10-star rave review in Laserbug): Digitiser, '3s & 5s' Dominos, Strip Jack Naked, Battleships, Morse Code, Def Chars. BBC Kaleidoscope: Coach/Horses, Darts, Concentration, Mapref, Plotters, £4.95 each. Roger. Tel: 061-799 9845.

21K Vic20, C2N, cassette unit, joystick, cartridge, 70 games, books, magazines. Games include Frogger, Scramble, Invaders. All boxed, only eight months old, cost £350, sell for £200. Tel:Phone: 0924 253251 (Mark).

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FOR BBC micro—Prism acoustic modem for Prestel use £40, also Watford Electronics 13 ROM socket extension board, £20. Pace DFS and manual, £20. Tel: Alan (0782) 314053 after 6pm.

ACORN AP-100 A printer (Seikosha), mint condition £125. Screen dumps, text editor, etc. In original box with manual. Call after 6pm or write to Dave Henninker, 207 Bruntsfield Place, Edinburgh EH10 4DH.

ATOM 12k RAM, 8k ROM, VIA, bus buffers, 4 tapes, year old, £80 inc. PSU Atom BBC board (unused) £30. Harris, 4 Field Rise, Burton-on-Trent. Tel: 42558. Postage extra.

BBC B games; Acornsoft Starship Command, £5. Colossal Adventure, £4. Kansas, F for Freddie, £5. Superior Software Frogger, £4. Alien Dropout, £4. Tel: (0222) 762948.

KOPYCAT and file Clone making complete tape backup package, working on the majority of BBC software. Only £3.45 inc to: Malcolm Paris, 38 Wooburn Manor Park, Wooburn Green, High Wycombe, Bucks HP10 0ET.

BBC Model B + disc interface, £470. Dual DS 40 track drives from Microware, £450. Acorn DFS manual and utility disc included. Tel: 031-667 4180 evenings.

PET 3000 series 32k high resolution board fitted (320 × 200), built-in sound port, cassette deck, games, books, £300 ono. Phone Robert Ciastko, Bradford 595288.

INTELLIVISION, console, two ordinary cartridges: Sea Battle, Advanced Dungeons and Dragons. Plus two voice cartridges: B17 Bomber, Space and Spartans. Worth over £200, will take £90. For details Tel: 01-950 2372.

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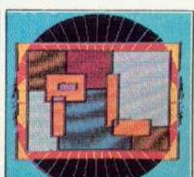
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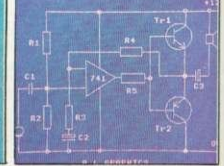
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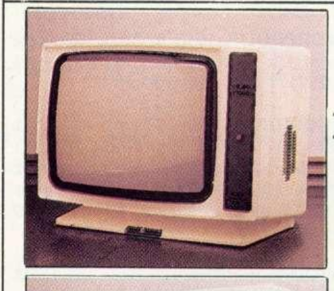
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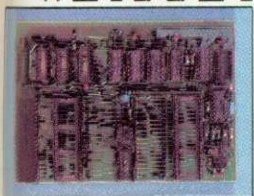
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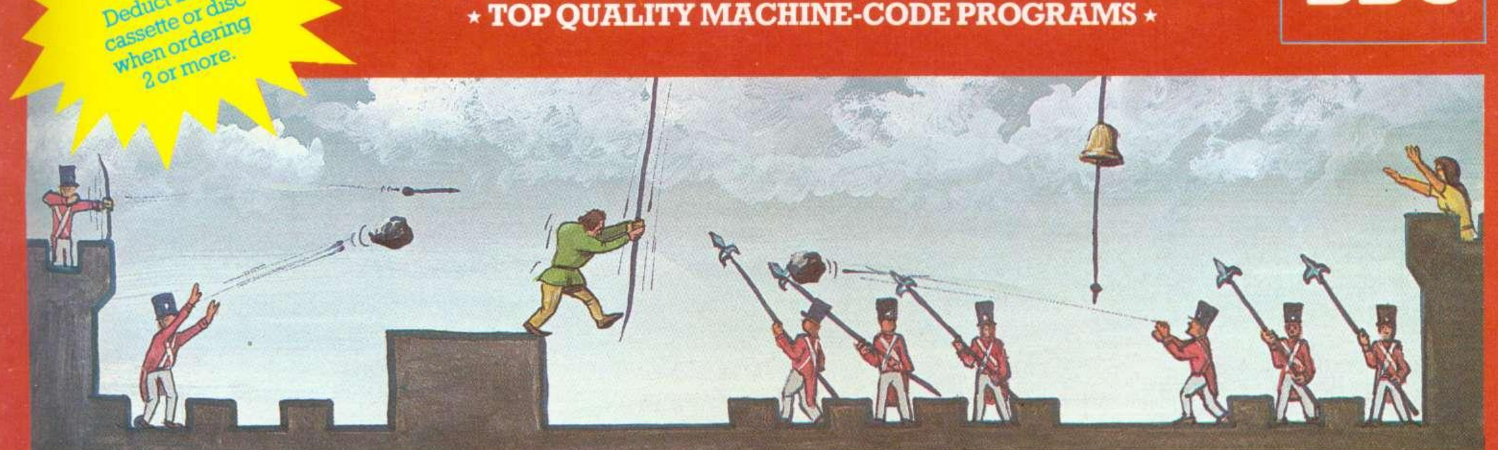
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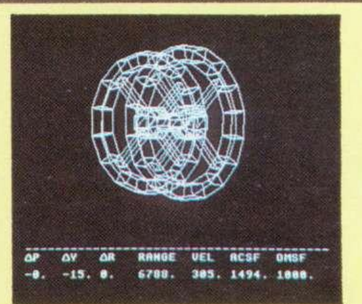




HUNCHBACK (32K) £7.95
An excellent version of the arcade game where Quasimodo attempts to rescue Esmeralda. Beautifully detailed animation (the best we've yet seen!) as Quasimodo leaps over the ramparts dodging rocks and arrows, swinging on ropes, avoiding the guards' spears, and ringing the bells. Twelve different screens of action! This program is sold under licence from Century Electronics Ltd; we have exclusive rights to its sale for use on the BBC micro.
(For use with KEYBOARD or JOYSTICKS).
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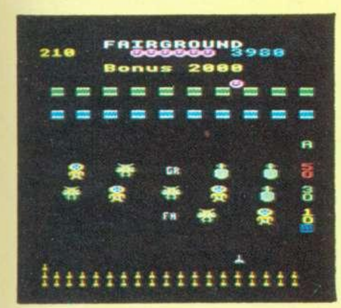
CRAZY PAINTER (32K) £7.95
The only full-feature version available for the BBC micro. On the first screen, you take the part of a monkey being chased by African tribesmen. If you manage to survive by painting-in all the squares, the bonus screen features the monkey trying to reach his bunch of bananas. After that, you take control of a paint-roller and each square painted-in adds to your score. But beware . . . the teddy-bears are now in hot pursuit. Superb animation and sound-effects.
(For use with KEYBOARD OR JOYSTICKS).
●●● *NEW RELEASE* ●●●



2002 (32K) £7.95
A space docking simulator using a 3D graphics to model the motions and responses of the ORION 4 spacecraft. Your mission is to pilot the shuttle to a "soft dock" with the space station. PITCH, YAW, ROLL, FORWARD, LATERAL and VERTICAL engines are provided together with orbit manoeuvering booster engines. 6 skill levels provide for the completely inexperienced pilot as well as the fully-fledged commander.
●●● *NEW RELEASE* ●●●



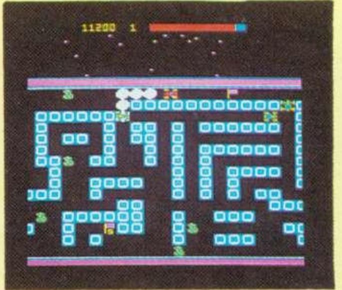
ALIEN DROPOUT (32K) £7.95
A novel and unusual program. Arcade-action with this exciting multi-stage shooting game. You have to shoot the aliens out of their "boxes" before the "boxes" fill up. Once full, the aliens fly down relentlessly, exploding as they hit the ground.
(For use with KEYBOARD or JOYSTICKS).
". . . these moths are out to get more than the clothes in your wardrobe.
. . . YOUR COMPUTER



FAIRGROUND (32K) £7.95
An exciting target-shooting game! Bonuses are scored for spelling out the word FAIRGROUND by hitting the appropriate target letters, and for shooting all the targets. Extra bullets are obtained by shooting the numercial targets, but watch out for the "smileys" who are intent on stealing your bullets. Music, sound effects, hi-score, and rankings.
●●● *NEW RELEASE* ●●●



CENTIPEDE (32K) £7.95
Incredible arcade-style game featuring mushrooms, snails, flies, spiders, and the centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, and increasing difficulty as the spiders become more lively and the number of mushrooms increases.
(For use with KEYBOARD or JOYSTICKS).
"Visually this game compares well with the arcade version, being colourful and clear."
. . . YOUR COMPUTER



ROAD RUNNER (32K) £7.95
The only full feature machine-code version available for the BBC micro. Features include: scrolling screen, radar display, 3 pursuing cars, checkpoint flags, fuel gauge, smoke screens, 6 skill levels, rankings, increasing difficulty, and sound effects.
(For use with KEYBOARD or JOYSTICKS).
"The game becomes very hard and has very smooth graphics. Excellent." . . . BEEBUG MAGAZINE.



FROGGER (32K) £7.95
Not just another version of Frogger . . . this is the arcade-action version that you've been waiting to see. Graphically brilliant with gaping-mouthed crocodiles, diving turtles, flies, and frogs that flex their legs as they jump along. Increasing difficulty, and responsive controls.
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". . . very good indeed . . . fast flicker-free graphics and a frog that really hops!" . . . BEEBUG MAGAZINE

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